THE SCOTTISH GEOGRAPHICAL MAGAZINE

Volume 69, No. 2 September 1953

THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY
EDINBURGH

ROYAL SCOTTISH GEOGRAPHICAL SOCIETY

Patron

HER MAJESTY THE QUEEN

President

JOHN BARTHOLOMEW, M.C., J.P.

Vice-Presidents

RT. HON. LORD ELPHINSTONE, K.T., LL.D., F.R.S.E.
SIR HUGH MCPHERSON, K.C.I.E., C.S.I.
RIGHT HON. THE EARL OF ROSEBERY, K.T., P.C., D.S.O., M.C., F.R.S.E.
*J. CAMERON SMAIL, O.B.E., LL.D., F.R.S.E.
ROBERT GRANT, F.R.S.E.
JAMES RITCHIE, C.B.E., D.SC., F.R.S.E.
*ARCHIBALD E. ROBERTSON, B.D., F.R.S.E.
ROLAND E. COOPER, F.R.S.E., F.R.S.G.S.
*DOUGLAS GUTHRIE, M.D., F.R.C.S., F.R.S.E.
ANGUS BUCHANAN, M.C., F.R.S.G.S.
ARTHUR W. RUSSELL, O.B.E., W.S.
SIR ERNEST M. WEDDERBURN, O.B.E., D.L., D.SC., LL.D., F.R.S.E., F.R.S.G.S.
RIGHT HON. THE EARL OF SELKIRK, A.F.C., O.B.E.
RIGHT HON. THE EARL OF WEMYSS AND MARCH
DOUGLAS A. ALLAN, D.SC., PH.D., F.R.S.E.
SIR EDWARD BAILEY, M.C., D.SC., LL.D., F.R.S., F.R.S.E., F.G.S.
*ALAN G. OGILVIE, O.B.E., B.SC., F.R.S.E., F.R.S.G.S.
*ALEXANDER HARRISON, C.A., F.R.S.G.S.
*JOHN JOHNSTON, O.B.E., T.D., M.A., F.R.G.S.
W. CLARK SOUTER, M.D.

* *Serving on Council*

Chairmen of Centres

Glasgow : JOHN A. FERGUSON, M.A., B.A.
Aberdeen : ANDREW C. O'DELL, M.SC., F.R.S.E.
Dundee : JOHN WATSON, M.A., B.SC.

Members of Council

As constituted 7th October 1952

Elected 1950

WILLIAM BURNS, C.I.E., D.SC., F.R.S.E.
GEORGE DOTT
JOHN B. FLEMING, M.A.
ARTHUR GEDDES, D.ÈS L., PH.D.
ALEXANDER GOOD
ALBERT B. HYSLOP
WILLIAM LATIMER, C.A.
HENRY M. PATON, M.A.
FRANCIS D. N. SPAVEN, M.A.
BETTY M. THIRD, M.A.
J. S. RUSSELL THOMPSON (*Glasgow*)

Elected 1951

DOUGLAS A. ALLAN, D.SC., PH.D., F.R.S.E.
JOHN C. BARTHOLOMEW, M.A.
C. M. BECKETT, T.D., M.A.
JEAN BELFRAGE
J. ALLAN BROWN
J. MACQUEEN COWAN, C.B.E., D.SC., F.R.S.E.
T. H. GILLESPIE, F.R.S.E.
JAMES HOSSACK, M.A., B.COM.
MRS A. F. C. LAMONT, B.SC. (OXON.) (*Glasgow*)
RONALD MILLER, M.A., PH.D.
J. M. MACKINNON
BRIAN K. D. ROBERTSON, A.F.C.
ARTHUR W. RUSSELL, O.B.E., W.S.
ERIK SCHACKE
CATHERINE P. SNODGRASS, M.A., PH.D.
SIR G. A. WILLIAMSON (*Aberdeen*)

Elected 1952

KATHERINE ADDISON SMITH
H. M. CADELL
ELIZABETH F. COMRIE
G. DALYELL OF THE BINNS, C.I.E., D.L., J.P.
ALEXANDER DOUGLAS
HORACE FAIRHURST, M.A., PH.D. (*Glasgow*)
IAN GRANT
JAMES G. HARLEY
ELEANOR A. HARPER GOW
ROBERT M. GALL INGLIS
ROBERT KERR, M.A., PH.D.
SIR HUGH MCPHERSON, K.C.I.E., C.S.I.
SIDNEY T. M. NEWMAN, M.A.(OXON.), F.R.S.E.
CHARLES J. ROBERTSON, M.A., PH.D.
GEORGE WATERSTON, M.B.O.U., F.Z.S.S., F.R.S.E.

Trustees—ROBERT GRANT, J.P., F.R.S.E.; D. ALAN STEVENSON, M.INST.C.E., F.R.S.E.; JOHN BARTHOLOMEW, M.C., J.P., M.A., F.R.S.E., F.R.G.S.

Honorary Editor—ISOBEL W. HUTCHISON, LL.D., F.R.S.G.S.

Hon. Librarian—CHARLES A. MALCOLM, O.B.E., M.A., PH.D., F.R.S.E.

Hon. Map Curator—J. C. BARTHOLOMEW, M.A.

Hon. Treasurer—J. ALLAN BROWN

Treasurer—SAMUEL CLARK CLAPPERTON
" *Glasgow:* R. DOUGLAS GOURLAY, C.A., 175 West George Street

Auditor—GORDON G. RUFFLE, C.A.

Hon. Secretaries—DONALD G. MOIR
Glasgow : JAMES B. GLEN, M.A., 9 Queensberry Avenue, Clarkston
Dundee : D. M. BROWN, B.A., Morgan Academy
Aberdeen : SIR G. A. WILLIAMSON, 6 Union Row

Secretary—Editor—JOHN H. KENNETH, M.A., PH.D., F.R.S.E., F.R.S.G.S.

SOCIETY'S ROOMS: SYNOD HALL, CASTLE TERRACE, EDINBURGH.

TELEPHONE: EDINBURGH, FOUNTAINBRIDGE 7776.

THE SCOTTISH
GEOGRAPHICAL
MAGAZINE

Vol. 69, No. 2 September 1953

THE GEOGRAPHICAL REGION: FORM AND FUNCTION

By G. W. S. Robinson

The concept of the Region is one so fundamentally necessary to the study of geography and at the same time so fatally difficult to define with precision and comprehension, that it is not surprising if, though long neglected in British literature after the passage of arms between Dickinson and Crowe in 1938-9,[1] it has recently attracted the attention of a number of writers distinguished not only for their eminence, but also for the variety of the paths by which they approach the subject.[2]

Kimble's chief aim is to question the regional concept itself, and for this reason alone it is impossible to do more than mention him at this point. Linton's aim is to put the concept on a firm foundation by building up his regions from their ultimate components, those small areas of sensibly uniform quality which by their ordered repetition stamp the character of a region. This atomic approach has recently been in favour in the German school as well,[3] and has been applied to the delimitation not only of morphological, but also of ecological and economic regions.[4] Wooldridge and East, besides interesting themselves in the problems which concern Linton, have been particularly impressed by the progress made in recent years in the study of " urban fields", and draw attention to the contrast between the region as an area throughout which there is substantial unity or uniformity of characteristics and the kind of region represented by the urban field, which has no such uniformity but constitutes the sphere of activity of a certain group of men.

The relation between these two types of region, with which this article is concerned, can profitably be studied by applying the atomic approach of Linton ; and such an application has in fact been made in the sphere of economic geography by Hans Carol in the course of studies concerned with the " Economic Map of Switzerland ".[5]

Regions that are defined by uniformity of characteristics or homogeneity of content Carol terms "formal", those that are defined by

economic coherence or interdependence of parts he terms " functional," contrasting, as others have done,[6] the points of view of morphology and physiology. But he proceeds further to examine the " atomic structure" of these two types of region. In the European agricultural environment with which he is concerned, the fundamental formal economic region is the field, the smallest area with a *homogeneous* economic personality ; the fundamental functional economic region is the farm, within which the farmer *organises* the exploitation of a defined area, circulating about it from his headquarters in the farm-house. If we imagine a number of such farms strung out along the side of a valley, we can suppose that each will exhibit a similar arrangement—let us say, meadow on the flood-plain, corn on the terraces, vines on the slopes, woodland above. Each of these crops will occupy a continuous strip the length of the valley, and each of these strips will constitute a formal region of the order next above the single field, *i.e.* a strip of country defined by uniformity of characteristics ; while each farm will remain a separate functional region, organised *transversely* to the longitudinal formal regions.[7]

If the valley we have postulated is flanked by other valleys with similar crops, they can be considered together as a single (formal) minor " land-use region " of the kind with which we are familiar from the reports of the Land Utilisation Survey and related studies ; and this may in turn be a component of a (formal) agricultural " belt " or major agricultural region. The farms of the various valleys, however, will not normally be related functionally. Each valley will support its own market town or towns, in which the farmers of that valley will sell the surplus product of their farms. These market towns may fall into the (functional) urban field of a city on the plain beyond, and eventually be so integrated (functionally) into the world economy. Again the higher tiers of functional and formal regions not only fail to coincide, they actually follow radically different patterns.

If it is to Carol that we owe the analysis of the atomic structure of formal and functional regions, the same is not true of the idea—nor even of these alliterative terms themselves. Penck, for instance, speaks of the form and function of a region, as do Dickinson and Hartshorne.[8] Whittlesey [9] distinguishes nodal regions and uniform regions ; Jones, [10] homogeneity and functional organisation ; Platt,[11] static areal homogeneity and areal functional unity. Crowe [12] introduces the concept of orbit, and Blanchard [13] contrasts the " hydrology " and morphology of a city.[14]

While the existence of these two points of view may thus be said to be widely accepted, their significance has, in fact, been interpreted in several different senses. Some earlier writers in particular, in their eagerness to ascribe to the " natural geographical region " every quality they could decently lay their hands on, refused to allow that formally and functionally defined regions will normally fail to coincide. Thus Penck [15] declares baldly that the region is an area that possesses unity of form and function. While Roxby,[16] whose major natural regions " combine a distinctive association of intrinsic conditions with a definite set of space relations ", and whose minor physical units

"tend to become economic units", treats as an abnormality the case of SE Essex, where the intrinsic conditions of the soil are found to be economically at variance with the factor of space relationship represented by the proximity of Greater London.[17] All the examples of formal and functional regions mentioned so far have tended, on the contrary, to illustrate the contention that the normal condition is for the functional region to be composed of parts of a number of formal regions; for men, whether actuated by economic, political or social motives, will strive to organise an area that combines within it a variety of resources.[18] The rule, however, is not to be taken as invariable. While the modern world may be said to comprise no more than two vast independent functional economic regions, the East and the West, Sieger warns us that at the other end of the scale there are primitive peoples whose living space cannot extend beyond a single tyrannical environment.[19] The contrast between these extremes is the contrast between widely differing "qualities of circulation".[20] There is, in fact, as Hartshorne concludes, simply "no correct answer".[21]

Other early British theorists in this field, Herbertson,[22] and more explicitly Unstead,[23] confine their view of the region entirely to the formal aspect. Herbertson ignored the functional aspect naturally as a result both of his conception of geography as a "science of distributions" and of his pre-occupation with generic regions.[24] Unstead subordinated it to a conception of the formal region as itself an organism, which "has certain characteristic modes of functioning" and "performs certain functions in the common life".[25]

Such one-sided views naturally stimulated a reaction, and some authors were emboldened to deny the validity of the formal aspect in regional definition altogether. Thus Crowe submits that his concept of Orbit "provides us with the dynamical key to regional geography"[26]; and Stevens claims that "the unity of the natural geographical region is achieved, maintained and developed by organisation, by cohesion, and this cohesion is attained and extended by intercourse. . . ."[27] Given the solidity and proven utility of the tradition based on the ideas of Herbertson, it is not surprising that these extreme expressions have found little response.

British readers will have been struck already by the similarity between the hierarchy of formal economic regions postulated by Carol and the hierarchy of land-form regions elaborated by Linton, and, in fact, the whole system of site-recognition based on the ideas of Bourne. Others will see a parallel with the school of Troll, who bases his hierarchy on Tansley's concept of the ecotope.[28] Wooldridge and East, in fact, go so far as to imply that the concept of the region as an area defined by uniformity of characteristics *is* the idea appropriate to physical geography.[29] Whether it is the only concept appropriate to physical geography is a question that must be discussed later. What is at least immediately plain from what goes before is that it is no less appropriate to human geography. The earth and its parts have been divided *ad nauseam* into regions based on similarity or homogeneity of land-use, of agricultural system, of industrial specialisation, of cultural status, of settlement or communication pattern, of population

density, of quality of cultural landscape, too numerous and too well-known to call for individual attention—and every one based on the principle that a piece of the earth's surface is characterised by homogeneity in a certain respect, in the same kind of respect, in fact, *mutatis mutandis*, as a site or "stow" or tract of Linton or Unstead [30] is so characterised.

But Wooldridge and East are in excellent company in their assumption that the functional approach is applicable only in the field of human geography. Almost all writers on this subject are, indeed, already thinking in terms of human geography: a few either indicate or imply as much,[31] or else, like Wooldridge and East, contrast the essentially formal method of physical geography with the essentially functional method of human geography.[32] Carol,[33] by emphasising the distinctiveness of the forces that go to the making of cultural, as opposed to natural, landscape (*i.e.* human foresight, human initiative and human community action), again implies that the "functional" approach is inappropriate to the treatment of "unorganised natural landscape".

But *is* the world of Nature unorganised? Crowe claims that "regional organisation must proceed from a system of human circulations",[34] but are there no circulations in nature? Are there not indeed circulations in nature more extended and more awful than any merely human running to and fro? The air of the heavens and the waters of the ocean are in perpetual and orderly motion. On the face of the land and beneath its surface proceeds the subtler, but no less orderly, movement of drainage and ground-water. The top surface of the land itself is continually shifted in vast quantities by the agency of air, stream-water and ice. Finally, the whole animal kingdom is in orderly movement of a quality barely distinguishable from many of the circulations characteristic of man himself. The orbit of a herd of reindeer is no less orderly than that of the Lapps who follow it; the territory of a foraging bird may be compared with that of a peasant cultivator; the *lebensraum* of a swarm of locusts closely resembles that of a horde of Tartar horsemen—to come no nearer home.[35]

Reverting to the valleys whose economies were considered earlier, we may suppose that each valley above the mountain-front will exhibit a broadly similar range of sites (e.g., flood-plain, terrace, steep concave wall, broad convex interfluve); and we shall have no hesitation in designating the whole area up-stream of the mountain-front a "stow", distinct in its formal characteristics from the country below the same line, quite regardless of the human occupance. But the actual movement of water and detrital material in the several basins is quite as distinct as is the farm-management of the neighbours in the example quoted earlier from Carol; and while each stream is behaving in a similar way in similar circumstances, the areas over which they function are integrated functionally not with each other, but with the several corresponding areas in the plain below the mountain-front, and the whole district is divided into a number of separate functional regions along the lines of water-parting.

In Northern Ayrshire, Linton recognises a number of small "areas

. . . characterised by repetition of a few characteristic sites over their whole extent." [36] The Ayrshire Raised Beaches, the Cunningham Lowland and the Cunningham Upland (with the Beith Plateau) constitute three belts of varying width parallel with the coast of the Firth of Clyde. But the country may equally be divided into the vales of the Glen Water, the Craufordland Water, the Fenwick Water, the Carmel Water, the Annick Water, the Lugton Water, the Dusk Water and the Rivers Irvine and Garnock, streams that flow from sources in the Cunningham Upland or Beith Plateau across the remaining zones to the Firth of Clyde.[37] These are the units that have been created by the activity of the individual streams, and are the separate orbits within which both surface and ground water function, affecting equally those parts of each basin that lie in each of the three zones of Linton. Again, if geomorphological processes are active in North Ayrshire to-day, while the whole extent of each of the three zones is no doubt undergoing similar modifications in whichever basin it lies, it is within each individual basin that the balance between erosion and deposition must be struck ; it is to the head-waters of the individual stream that we must look for the source of the material deposited in its lower reaches. It is equally with these functioning basins that the practical geomorphologist or hydrologist has to reckon in dealing with problems of erosion, beach-formation, drainage or flood-control. The river-basin as a " natural region " held sometimes a disproportionate place in early systems of geography. Its functional significance has latterly been more clearly grasped by engineers and practical men than by academic geographers.

In this same part of Northern Ayrshire, Lebon recognises three Land-Use (sc. agricultural) Regions, again running parallel with the coast of the Firth of Clyde : the Coastal Arable belt, the Intermediate type and the Renfrewshire Border.[38] But there can be little doubt that the economic relations of a farmer in the upper Annick valley will be closer with the creamery at Stewarton, in the Intermediate Zone, than with any part of the Renfrewshire Border, in which his farm lies.[39]

The area may similarly be divided into a series of formally defined climatic regions again running parallel to the coast, each one as we proceed inland rawer than the last. But there is only one functional region : the meteorological circulations responsible for the conditions are the same throughout ; only their effect has been modified through altitude and distance from the sea.

In the same way the Indian Monsoon air-stream dominates during the wet weather both Bombay and Poona ; but the rainfall at these places amounts to 72½" and 27½" respectively, and they fall in the climatic provinces (Koeppen) of Tropical Savanna (Am) and Steppe (BS). The " Monsoon Climate " is a functional, not a formal entity.

By so recognising the distinction between formal and functional regions in nature as well as in society, we are in a position to restore unity of outlook to the whole subject, a unity in danger of being disrupted by the fundamental antithesis postulated by Wooldridge and East between "urban regions, which depend for their existence on social functions" and "regions . . . based on the association of sites,

which are solely physical divisions. . . ." This unity of outlook does not imply that there will be any coincidence between the two kinds of region, formal and functional—on the contrary, both in nature and in society their patterns tend to be antagonistic—but that the same distinction between the two approaches can be drawn all the way across the field of geography, from the study of the firm ground on which we stand to the consideration of the most delicate problem of frontier adjustment.

The degree to which the pattern of functional regions will diverge from that of formal regions in any particular context or branch of geography will depend on the " quality of circulation " or the scale of the functional relations of the phenomena concerned. Functional relations in meteorology and in modern economy are rapid, far-reaching and potent, so that the formal and functional patterns may be expected to be widely different. But in the whole vegetable kingdom, owing to the static habit of the plant, these relations are, though active, normally restricted to a range below the scale with which the geographer needs to concern himself. It is no doubt an instinctive appreciation of this fact that had led thinkers whose concern is mainly to devise formal regions to look to the vegetable kingdom for their criteria, their " emblems " (Herbertson, Passarge, Koeppen, Troll).[40] Regions characterised by differences of vegetation are particularly easy to handle as formal regions, but can for the same reason be particularly tricky to handle as bases for a system of " geographical " or general purpose regions. The coincidence of formal and functional regions that is found in the vegetable kingdom cannot be assumed to operate in other spheres.

The distinction between formal and functional regions is in some senses parallel with that between generic and specific ; generic regions being essentially characterised by certain inherent qualities, without regard to location ; whereas the essence of the specific region is its geographical position—and " geographical position " (except in the sense of mathematical relation to the poles) is a concept without significance except in so far as we take into account the functioning of forces, natural or social, that may link, or have linked or do link, one area or point with other parts of the surface of the globe.[41]

If geographical position is essentially a " functional " concept, what of " landscape " ? According to Dickinson the hallmark of the landscape school is the " morphological approach ".[42] Schlueter, founder of the school, suggested that human geography should aim at " the recognition of the form and arrangement of the earth-bound phenomena " ; while Sauer, its main proponent in English, speaks of a region (landscape) as an area made up " of a distinct association of forms both physical and cultural". The approach, in fact, is essentially formal, and it is from the formal point of view that the landscape idea can make its valuable contribution to the delimitation of regions. But when enthusiasts are emboldened to put this concept at the heart of geography, or even to define the subject in terms of landscape, we soon find that the circulations that are fundamental to the definition and delimitation of functional regions are either not palpable in landscape

at all or else are represented there only by comparatively insignificant " mobile landscape elements "—so that the pure doctrine must somehow be modified to admit a more balanced view of geographical reality. Thus Krebs " overcomes this difficulty " since he " sees in the landscape the main object of geographical study, but includes in his regional concept . . ." such functional relations as he thinks fit. It is to such modifications that Crowe no doubt refers, when he slyly characterises the whole of landscape philosophy as " a process of removing from one's hat the very things one has carefully put into it." [43]

Finally, it is worth emphasising that formal regions and functional regions need not be regarded as two parallel, separate systems. They do not build up into two water-tight regional hierarchies. A formal region may stand in a functional relation to other formal regions in the same context; and functional regions that resemble each other may comprise a formal region which possesses homogeneity of function —though it need have neither formal unity nor functional cohesion.

So, to revert to the agricultural context within which we set out, the individual formal cells—vineyard, cornfield, meadow—of each farm are integrated by the farmer into an elementary functional region, which is the farm. From the farms we may in turn construct a formal region of the second order, covering the area over which the same type of farming (as opposed to crops or fields) predominates.[44] All the farms of the vineyard-slope, having the same economy (or type of functioning), will belong to this formal region, regardless of the fact that they may look to different markets to sell their wine, and so, in this sense, belong to different functional regions of a higher order. The corresponding farms on the opposite (i.e. shady) side of the valley, though they belong to the same functional regions as the vineyard farms—since they sell their dairy products at the same markets at which the wine is sold—comprise a separate formal region of the second order, because their economy or functioning is of a different character, being centred on animal husbandry. The boundary between these two formal regions of the second order might even be invisible on the ground, passing as it probably would between formally identical cells of meadowland on the valley bottom. This strip of meadowland makes, like the strips of cornland and vineyard, one formal region of the first—purely formal—order; but is divided when we construct formal regions composed of cells that are themselves functional regions.

From this elementary example it is possible to deduce that the theoretical distinction between the formal region and the functional region can make the concept of the region a more accurate instrument, but *not* a simpler one. The phenomena are not simple, and any theory that relies on a simple solution can lead only to confusion. What we require are signposts through the complex reality; and the distinction drawn in this paper claims to be no more than one such signpost which we disregard at our peril.

[1] Crowe, P. R. On Progress in Geography. *S.G.M.*, 1938, 54(*1*): 1-19.

Dickinson, R. E. Landscape and Society. *S.G.M.*, 1939, 55 (*1*): 1-14. Note by P. R. Crowe, *ibid.*, pp. 14-15.

[2] Wooldridge, S. W., and East, W. G. The Spirit and Purpose of Geography. London : Hutchinson's University Library, 1951. Chapter 8.

Linton. D. L. The Delimitation of Morphological Regions. Kimble, G. H. T. The Inadequacy of the Regional Concept. In : London Essays in Geography, edited by L. Dudley Stamp and S. W. Wooldridge. London : Longmans, Green & Co. Ltd., 1951.

[3] Otremba, E. Die Grundsätze der naturräumlichen Gliederung Deutschlands. *Erdkunde*, 1948, 156-167. For a map corresponding to Linton's : Die naturräumliche Gliederung Deutschlands, 1:200,000, Sheet 170 Stuttgart, by Dr. F. Huttenlocher, Landshut : Amt für Landeskunde.

[4] Paffen, K. H. Oekologische Landesgliederung. *Erdkunde*, 1948, 167-173.

Carol, H. Die Wirtschaftslandschaft und ihre kartographische Darstellung. *Geographia Helvetica*, 1946 : 246-279.

[5] Carol, H. *Op. cit.*, pp. 255-262.

[6] Unstead, J. F. Geographical Regions Illustrated by Reference to the Iberian Peninsula. *S.G.M.*, 1926, 42 (*3*) : 159-170, p. 168.

[7] Derruau, M. (La Grande Limagne. Clermont-Ferrand, n.d.) draws a parallel distinction between a *terroir* and a *finage*, the first being defined as " un territoire cultivé se distinguant de ses voisins par des caractères particuliers . . . ", the second as " l'ensemble du territoire attribué à une cellule rurale."

[8] Penck, A., quoted by Dickinson, *op. cit.*, p. 3. Dickinson, R. E. *Op. cit.*, p. 4.

Hartshorne, R. The Nature of Geography. *Annals of the Association of American Geographers*, 1939 : 171-685, p. 441.

[9] Whittlesey, D. Regional Geography and the Geographic Region. *Ibid.*, 1950 : 155-157, p. 156. Ullman, E. L. Human Geography and Area Research. *Ibid.*, 1953 : 54-66.

[10] Jones, Wellington D. Procedures in Investigating Human Occupance of a Region. *Ibid.*, 1934 : 93-111, pp. 106-107.

[11] Platt, R. S. Field Approach to Regions. *Ibid.*, 1935 : 153-174, p. 171.

[12] Crowe, P. R. *Op. cit.*, p. 14.

[13] Quoted by Dickinson, R. E. City, Region and Regionalism. London : Kegan Paul, Trench, Trubner & Co. Ltd., 1947, p. 144.

[14] Among German writers a number of other terms have found favour at different times. One may mention : *Charakterlandschaft* und *Zwecklandschaft* (W. Vogel, Politische Geographie. Leipzig and Berlin, 1922) ; *Landschaften* und *Sphären* (H. Schrepfer, Einheit und Aufgabe der Geographie als Wissenschaft. In Petersen-Schrepfer, Die Geographie vor neuen Aufgaben. Frankfurt, 1934) ; *totalisierende* und *zentralisierende Züge* (G. Braun and W. Hartnack, Die Preussische Provinz Pommern bei der Neueinteilung Deutschlands. 49-50 *Jahrbuch der Pommerschen Geographischen Gesellschaft*)—a contrast illustrated by Lautensach (Ueber die Erfassung und Abgrenzung von Landschaftsräumen. Comptes rendus du Congrès international de Géographie, Amsterdam, 1938, II., V. : 12-26) by comparing his own formal regional division of Portugal, made for descriptive purposes, with the functional regions devised by Girão and others for administrative purposes (La Division provinciale de l'État Nouveau Portugais, *Boletim de la Sociedad de Geografia de Lisboa*, 1938, 56 (*5-6*) : 195-200).

[15] Quoted by Dickinson, R. E. Landscape and Society, p. 3.

[16] Roxby, P. M. The Theory of Natural Regions. *Geography*, 1926 : 376-382.

[17] So Paffen (*op. cit.*) seems to claim for his ecotopes both homogeneity and functional unity : " ökologisch mehr oder weniger einheitlich funktionierenden homogenen Charakter."

[18] *Cf.* Jones (*op. cit.*, p. 105) : " Many extensive areas which may be unified from the viewpoint of functional organization do not necessarily coincide with the more striking landscape units." And Kimble (*op. cit.*, p. 154) : " Not all homogeneity

spells unity or coherence: . . . per contra, unity is frequently the product not so much of *uniformity* of terrain, climate and resources, as of *contrasted* physical and economic conditions integrated by commercial movements and/or political ideals." Unfortunately, this author does not develop the theme, which might have helped to explain some of the contradictions in regional definition that he notes with such spirit elsewhere. We may compare here the concept of *Harmonious Landscape* (GRADMANN, R. Harmonisches Landschaftsbild. *Zeitschrift der Gesellschaft für Erdkunde*, Berlin, 1924; TROLL, C. Die geographische Landschaft und ihre Erforschung. *Studium Generale*, 1950, p. 176). When there is close agreement between natural landscape and cultural landscape, harmony prevails. When the economic forces begin to *function* on a scale broader than that on which the natural forces are being studied, so as to mask the " natural " pattern, then *Disharmony* is invoked.

[19] SIEGER, R. Natürliche Räume und Lebensräume. *Petermanns Mitteilungen*, 1923: 252-256, p. 255.

[20] CROWE, P. R. *Op. cit.*, p. 18. [21] HARTSHORNE, R. *Op. cit.*, p. 442.

[22] HERBERTSON, A. J. The Major Natural Regions. *Geographical Journal*, 1905, 25: 300-312.

[23] UNSTEAD, J. F. A System of Regional Geography. *Geography*, 1933: 175-187.

[24] *V. inf.*, p. 7.

[25] UNSTEAD, J. F. 1926, p. 169 and 1933, p. 184.

[26] CROWE, P. R. *Op. cit.*, p. 14.

[27] STEVENS, A. The Natural Geographical Region. *S.G.M.*, 1939, 55 (*6*): 305-317, p. 310.

Cf. HARTKE, W. (Gliederung und Grenzen im Kleinen. *Erdkunde*, 1948: 174-179), who is prepared to claim first place in regional definition for the criterion of the journey to work.

[28] TROLL, C. Die geographische Landschaft und ihre Erforschung. *Studium Generale*, 1950: 163-181, pp. 169 sqq.

[29] WOOLDRIDGE, S. W., and EAST, W. G. *Op. cit.*, pp. 146-147 and 160. I hope I take the sense of the entire passages, especially " The definition of structural, morphological and soil regions assumes that there is substantial unity throughout " and " Regions . . . based on the association of sites . . . are solely physical divisions."

[30] UNSTEAD, J. F. *Op. cit.*, 1933, passim.

[31] WHITTLESEY, D. *Loc. cit.* PLATT, R. S. *Loc. cit.*

[32] WOOLDRIDGE, S. W., and EAST, W. G. *Op. cit.*, especially pp. 150-151 and 159-160. " We have focussed attention here on regions of two types . . . (which) claim the attention of geography as a whole as distinct from its specialist branches. . . ." " While Urban Regions depend for their existence on social functions . . . regions . . . based on the association of sites are solely physical divisions. . . . The physical region is a virtually static entity."

[33] CAROL, H. *Op. cit.*, p. 249. [34] CROWE, P. R. *Op. cit.*, p. 13.

[35] WHITAKER, J. R. (Regional Interdependence. *Journal of Geography*, 1932: 164-165) refers in the same breath to a wide variety of " phenomena of a circulatory nature—the movement of winds, waters, animals, plants, etc., as well as of goods, men and information." He cites sand-dunes, flood sediment, stream modification, animal and plant migrations, trade, human migration (temporary), means of communication.

See also the discussion of transport or circulatory phenomena in HARTSHORNE, R., *op. cit.*, p. 270.

[36] LINTON, D. L. *Op. cit.*, p. 209 and pp. 213-215.

[37] Only the rivers in fact reach the sea; but the argument is scarcely affected by this local circumstance.

[38] LEBON, J. H. G. *The Land of Britain.* Part I. Ayrshire. London: Land Utilisation Survey, 1937.

[39] FLEMING, J. B., and GREEN, F. H. W. Some Relations between Country and Town in Scotland. *S.G.M.*, 1952, 68 (1) : 2-12.

[40] A more recent example is from F. HUTTENLOCHER, Versuche kulturlandschaftlicher Gliederung am Beispiel von Württemberg (*Forschungen zur Deutschen Landeskunde*, Band 47. Stuttgart, 1949). He speaks of " die Pflanzengesellschaften . . . , die als Indikatoren aller Standortsmerkmale und damit der gesamten Naturausstattung dienen."

[41] HARTSHORNE, R., *op. cit.*, points out that " The locus of Egypt in reference to the tropical highlands to the South was a major factor in the development of the soils and natural vegetation of the Nile valley long before the first man appeared upon the scene." An admirable example of the role of the circulatory phenomena of nature in defining geographical location.

[42] DICKINSON, R. E. *Op. cit.*, pp. 1-4. Quotations in this paragraph from Schlüter, Sauer, and Krebs from the same source.

[43] CROWE, P. R., *S.G.M.*, 1939, 55 (*1*) : 14-15. We must certainly exempt from this stricture OTREMBA (Der Bauplan der Kulturlandschaft. *Die Erde*, 1951-52 : 233-245), who plans to centre the study of cultural landscape round the idea of *intensity*, which he appreciates as a manifestation of functional forces : " Der Kulturlandschaftsbegriff umfasst zwangsläufig das Funktionale mit. . . ."

[44] *Cf.* HARTSHORNE, T. *Op. cit.*, pp. 351-352.

A VIEW OF SCOTLAND IN THE MIDDLE OF THE EIGHTEENTH CENTURY

By ANDREW C. O'DELL

AFTER the closing episodes of the " Forty-Five " Lt-Col. David Watson (1713 ?-1761) submitted a scheme for a survey of Scotland, and the Hanoverian King, impressed with the value of a detailed map for a country which had twice required military campaigns in one generation at once ordered work to proceed. David Watson was appointed Superintendent, with the title of Deputy-Q.M.G. in Scotland under the Duke of Cumberland, and a brigade of engineers was sent to act under his orders. The engineers were not solely concerned with mapping for, pursuing Marshal Wade's plan of improved communications, roads were also constructed. Watson had two assistants, William Roy and, from 1752, his own nephew Sir David Dundas (1735-1820).

William Roy (1726-1790), with whose name the map has become associated, was born at Milton Head in Carluke Parish, Lanarkshire, and showed promise of his pre-eminence as a surveyor in this survey of the mainland of Scotland, which culminated in 1783 with the measurement of the historic base-line on Hounslow Heath for the triangulation connecting the observatories of Greenwich and Paris. Work on the Scottish Survey proceeded until 1754-5, when alarm at a threat of invasion from France resulted in the withdrawal of these skilled surveyors to the south coast in order to plot defence works.

The original maps completed by 1754—the north in 84 rolls and the south in 10 rolls —were deposited with the King as also were several reduced plots and so passed with King George III's Library into the care of the British Museum. The original work which was on a scale of

1000 yards to 1 inch, was described by Roy as "rather . . . a magnificent military sketch than a very accurate map of a country." It was intended to revise and complete the work, but the outbreak of war in 1755 put a stop to this project and all that then materialised to the world was a map reduced by Watson and Roy and published, as a single sheet, by T. Chievos and appropriately known as the King's Map.

A photographic copy of a reduced plot was made in 1937 for the University of Aberdeen library. The scale of the original of this is given as 1¾ inches to a mile and there has been a slight further reduction in the photographic copying. Without a triangulation basis, the survey was by compass traverse and there are also undoubtedly personal differences given by different surveyors. Furthermore, there is distortion in the survey framework, as the two trapezia in Figure 1 represent equal-sized squares of territory. Nevertheless the survey is a careful piece of field work, and by simple conventions are shown open fields, enclosed fields (often with shelter belts), plantations, natural woodland, rough hill land, marshes, roads, buildings and villages.

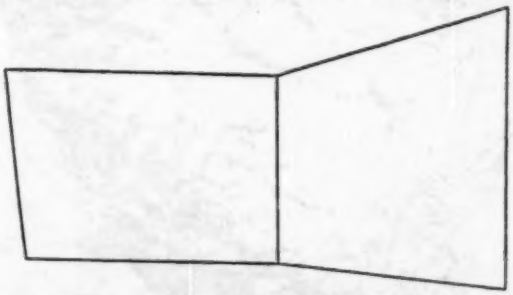


Fig. 1. Two adjacent 10 km. squares were located in the Tweed valley and the corner points transferred to the Roy map. These trapezia are an indication of the distortion which occurs.

Furthermore, the map is a quarry for place-names. While one is sceptical of the precise location of certain details, these distortions may well be due to compass traverse and using hill-tops for completing the survey, and there is every reason to believe that the map is a faithful record. It is curious that while geographers have been aware of the existence of this general map (*vide* L. D. Stamp, *Land of Britain, Its Use and Misuse*, p. 51) there has been no previous attempt, so far as the writer is aware, to bring the whole of the mainland of Scotland on to a corrected base and to show the mid-eighteenth century situation in Scotland.

Using the photographic copy, various elements of the map were plotted on to the Ten-Mile Physical Map published recently by the Ordnance Survey. It was found that river valleys were invaluable in location of detail and distortion of the original was corrected, so far as was possible, against relatively stable physical features; alteration of the channels in the Clyde and Forth upper estuaries and the formation of reservoirs were the most troublesome changes. A number of the land-use features were plotted in colour and from these the following black-and-white analysis maps have been prepared.

At the time of the Land Utilisation Survey, 1931-9, there was a paucity of tilled land in the Highlands, the little advance into the southern dales and the blank areas due to urban sprawl in the Central Lowlands. By contrast is the farmed land—openfield and enclosed—of two centuries ago. To the north west and west are numerous patches of coastal and glen settlement, but in the Old Red Sandstone areas of

Fig. 2. Farmed land, openfield and enclosed, on mainland of Scotland, according to Roy's maps. No outline for coast.

the north and of Strathmore and in the north east elbow, reclamation from waste had not as yet gone far. Fife obviously was agriculturally more than a golden fringe, while tilled land occurred where now spread the industrial town and metropolis. The great ribbons of agriculture on the interfluves in Cunningham as well as in Kyle in Ayrshire and the corridors of activity in the dales of the Southern Uplands are also conspicuous. Changes indeed, yet the basic regional differences of Scotland still stand revealed.

The second map based on Roy is of the enclosed farm land which includes arable and some pasture land. A slender patchwork is due to reclamation—as along the Solway shore—and to the improvement by landlords—as by the Grants of Monymusk. The Solway lowland, the Clyde, Forth and lower Tay valleys stand out as regions of greatest interest in this form of agricultural improvement. When reflection is

Fig. 3. Enclosed farm land, according to Roy's maps. Pecked : coast of islands for which no detail available.

made of the changes which took place by the time of the first Ordnance Survey maps of Scotland, some realisation is obtained of the immensity of agricultural activity which was simultaneous with the Industrial revolution.

The modern L.U.S. map shows the woodlands of Scotland immediately prior to the outbreak of the recent war. Practically no indigenous woodland remains and the whole is based on plantations, with Niths-

dale, the Atholl district, Deeside, Speyside and the Moray lowlands conspicuous areas, again a man-made feature which compares sharply with the plantations, many of which were to beautify policies, two hundred years ago. The plantations then were primarily a lowland feature for, as the last map shows, there was much indigenous woodland remaining in the uplands. It is true there are fine ribbons of shaws

Fig. 4. Plantations, according to Roy's maps.

along the gorge sections of river valleys in the lowlands, but basically most is found in the uplands. Perhaps as soldiers these surveyors were conscious of woodland as providing cover for an enemy and carefully marked all. Be that as it may, the Highlands had an arboreal wealth which was about to be removed—where it could be reached—by the ironmasters seeking charcoal as fuel, and in Speyside by shipbuilders. The pattern given here is the remnant left before industry and sheep

flocks and preserved herds of deer had played their part in devastation.

This map, together with Webster's first Enumeration of the People, permits the preparation of a detailed population of Scotland for about 1751. These surveyors have left us a picture of Scotland on the eve of great changes—agriculture being modernised, industry moving

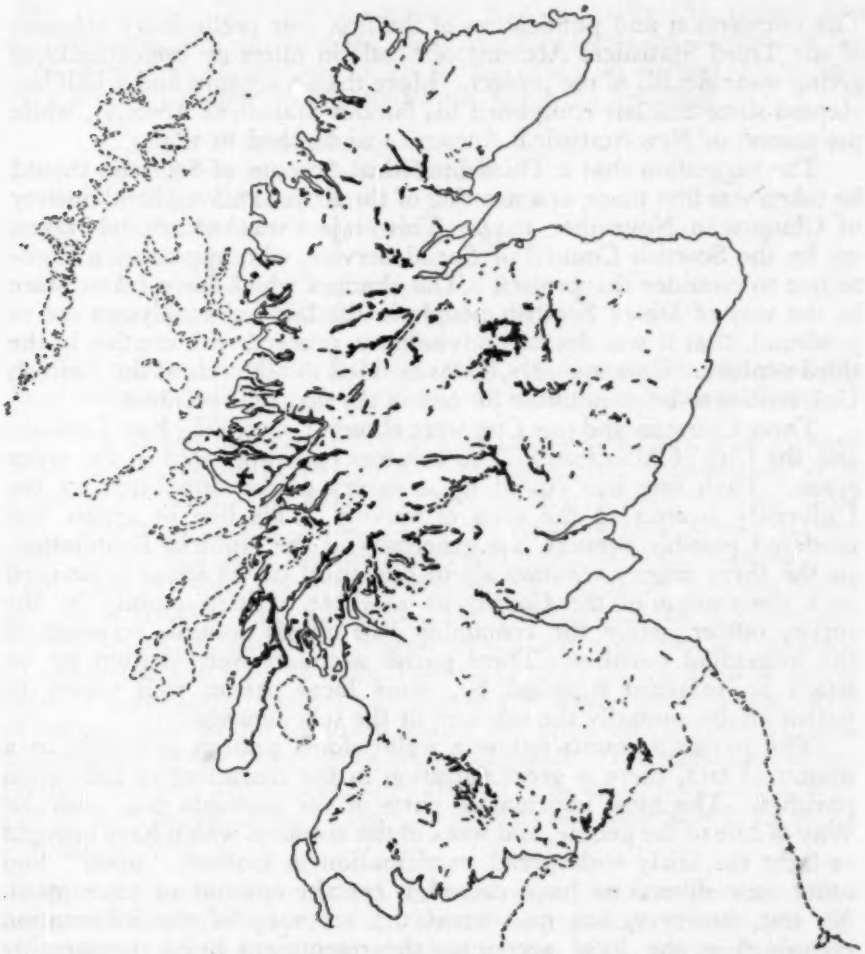


Fig. 5. Woodlands, according to Roy's maps.

from the home to the factory, communications being improved from the road with fords. A fascinating view is given of past conditions and the story of Scottish economic conditions, as viewed through maps, is enriched by the scheme of Watson executed by Roy and Dundas.

Paper read before Section E of the British Association, Edinburgh, 14th August 1951.

THE THIRD STATISTICAL ACCOUNT OF SCOTLAND

By J. G. Kyd

The completion and publication of the first four preliminary volumes of the Third Statistical Account of Scotland offers an opportunity of giving some details of the project. More than a century and a half has elapsed since Sinclair completed his famous Statistical Account, while the second or New Statistical Account was finished in 1845.

The suggestion that a Third Statistical Account of Scotland should be taken was first made at a meeting of the Royal Philosophical Society of Glasgow in November 1944. This project was immediately taken up by the Scottish Council of Social Service, who appointed a Committee to consider the project. The changes which have taken place in the way of life of Scottish people in the last hundred years are so profound, that it was deemed advisable to proceed with caution in the third venture. Consequently, it was decided to ask each of the Scottish Universities to be responsible for one of the first four volumes.

Three Counties and one City were chosen : Ayr, Fife, East Lothian, and the City of Aberdeen.[1] The volumes have appeared in the order given. Each one was edited by a survey officer appointed by the University nearest to the area of survey. This line of action was rendered possible through the generosity of the Nuffield Foundation. In the three county volumes about one third of the space is devoted to a description of the County as a whole, written mainly by the survey officer, while the remaining two thirds contain accounts of the individual parishes. These parish accounts were written by, or based on material supplied by, some local person well versed in parish affairs—usually the minister or the schoolmaster.

The parish accounts follow a well-defined pattern although, as a matter of fact, there is great variation in the treatment of individual parishes. The most informative parts of the accounts deal with the Way of Life of the people, and some of the accounts which have brought to light the fairly widespread participation in football " pools " and other new diversions have caused a certain amount of resentment. No one, however, has questioned the accuracy of the information contained in the local accounts—the resentment being presumably due to the fact that the habits of the local people have been brought to light.

The writers of these local accounts have set down the facts as they know them without fear or favour and certainly without malice. They have endeavoured to give a true picture of parish life as it is to-day during this bewildering epoch in the history of our country. Were the facts relating to the habits of the people—whether they be good or bad—not recorded, the Third Statistical Account would never take its place along with the First and Second Accounts as a true picture of parish life in Scotland at the time the record was made.

The Remaining Task

While these four preliminary surveys were in course of preparation, it was deemed advisable to endeavour to obtain writers for the accounts of parishes in the areas outwith the preliminary surveys. The course followed was very much on the lines of that adopted by Sinclair in his first Account. The parish minister was normally the person first approached, and in the vast majority of parishes he undertook the task of writing an account of his parish based on certain broad lines which were supplied to him under the following headings :

(1) The Physical Basis.
(2) History of the Local Community.
(3) Population.
(4) Public and Social Services.
(5) Housing.
(6) Agriculture, Industries, and Commerce.
(7) The Way of Life.

The following extract from the notes supplied to the writers of the local accounts indicates the lines on which the plan is proceeding :

" We should like the reports to give facts which cannot be gleaned from normal books of reference ; we should like information as to modern agricultural methods and the machinery used and how these have altered in recent times. We want to know how people occupy their leisure and how they amuse themselves and what changes have taken place in this aspect of communal life. What is the reaction of people to religion and to church-going generally ? Has the development of secondary education altered the attitude of parents and children to education and has the centralisation of secondary schools in larger areas of population involved an alteration in family life ? A good deal of information should be given about the great changes which have taken place in the transport facilities available ; the radiation of bus services to rural areas must have altered very materially the outlook and lives of people living in isolated districts and facts should be given relating to this."

In some cases, the minister for one reason or another could not undertake the task but where this was so, it was usually found that the schoolmaster or some other suitable person was prepared to act. Apart from the three cities of Dundee, Edinburgh, and Glasgow, there are 730 parishes outwith the area covered by the preliminary surveys. In all but about a dozen of these, writers have been found, and at the end of May 1953 actually 537 completed parish accounts had been received from the local writers—the vast majority being parish ministers. The remaining accounts are coming in steadily.

Through the generosity of Glasgow Corporation, work has started on the volume, or volumes, for the City of Glasgow under the general supervision of the Department of Social and Economic Research of Glasgow University.

Sinclair published the parish accounts in volumes without any segregation in counties as was done in the Second Account. The plan which is proposed for the Third Account is that the individual parish accounts are read by an editor and where it is deemed advisable to make some amendments in the writer's manuscript, this is agreed between the editor and the writer of the account. It is intended that all the parish accounts relating to a County will be brought together and published with a general survey of the County as a whole, written around the parish accounts and dealing with subjects which appertain to the County area.

While it is hoped to obtain much information relating to the economic, social and industrial life of the parishes, the main idea behind the preparation of this Account is to give a faithful picture of the Way of Life of the people in the parishes of Scotland in the middle of this century. Times have greatly changed since the First and Second Accounts were prepared and much scholarship and energy have been expended on Scottish books of reference and on the history and geography of the country. Many of these works have dealt with Scotland as a whole and others with individual parts of the country. It may therefore be felt in some quarters that, with this much greater reservoir of information about the country as a whole and about individual Counties, the taking of a Third Statistical Account is unnecessary. The main idea behind the preparation of the Account is, however, to obtain local information upon matters in respect of which facts are not available in the normal books of reference.

The conception behind the project is well stated in the following extract from the original brochure issued by the Scottish Council of Social Service :

" The main task will be to describe not merely the physical facts, the public and social services, and the industries of the area, but to show how, in that environment and with those material conditions, the people *live*. We shall want to know not only about houses, but about family life, not only about churches, but about what religion means to people, not only about industries and products, but about the attitude of the people to work and leisure. We shall want to know of any significant changes that have occurred in customs, feelings and attitudes. And we shall want to know their hopes and prospects for the future."

Contributed by Mr J. G. Kyd, C.B.E., F.F.A., F.R.S.E., Chairman, Statistical Account Committee.

[1] *The Third Statistical Account of Scotland.* 9×5¾. *Ayrshire.* By JOHN STRAWTHORN, M.A., PH.D., and WILLIAM BOYD, M.A., B.SC., D.PHIL., D.LITT., LL.D. Introduction by James Cunnison. Pp. xviii+886. 50 figs. Map. [1951] *The County of Fife.* By ALEXANDER SMITH, M.A. Introduction by Professor J. W. Nisbet, M.A., LL.B. Pp. xvi+816. 28 figs. 12 plates. Map. [1952.] *The County of East Lothian.* By CATHERINE P. SNODGRASS, M.A., PH.D. Introduction by Sir Alexander Gray, C.B.E., M.A., LL.D. Pp. xvi+460. 52 figs. 8 plates. Map. [1953.] *The City of Aberdeen.* By HUGH MACKENZIE, D.S.O., M.A. Introduction by Professor Henry Hamilton. Pp. xvii+599. 20 figs. 8 plates. Map. [1953.] Edinburgh and London : Oliver and Boyd Ltd. 20s. per volume.

1. LEVEES OF IORSA WATER AND LOCHANS (A and B) IN FLANKING DEPRESSIONS

2. GLACIATED TROUGH OF GLEN IORSA
BEHIND LOCH IORSA IS THE FLOOD PLAIN WITH LOCHANS

3. ERODED *MOLINIA* TUSSOCKS ON LEVEE OF IORSA WATER

ON THE ORIGIN OF CERTAIN LOCHANS IN GLEN IORSA, ARRAN

By J. N. Jennings

Introduction

Lakes of various types are common features of alluvial flood plains, often arising from the peculiarities of river behaviour. Oxbow-lakes constitute a simple type in this category, and examples are known from Britain. But the formation of lakes in the back-swamp areas of a flood plain or in tributary valleys through aggradation by the main stream is a process which, though long recognised in the literature of geomorphology, has not to the writer's knowledge been clearly demonstrated to occur within this island. One can turn to no less a name than that of W. M. Davis [1] to find a classic example of this nature. The Red River, heavily laden with waste from its headwaters in Llano Estacado of Texas, is rapidly aggrading its flood plain in Louisiana where its profile is very gentle. Its tributaries are unable to raise their own flood plains at the same rate, with the consequent formation of lakes in the distal parts of their valleys. Even more impressive instances occur in the lower Danube valley near the delta, though the changing level of the Black Sea in the Pleistocene is also involved here.[2] Since, however, such lakes do not appear to have been recognised in Britain, it was with an interest quite disproportionate to their size that the writer encountered in 1948 certain small lochans in Glen Iorsa in the Isle of Arran (Photograph 1), which at first sight were deemed to have a similar origin. These lochans lie not in side valleys but in the flood plain of the Iorsa Water itself, though off the course of the river, and the theory that they were due to its levee building arose from a cursory reconnaissance of the area. Because of their theoretical interest, Glen Iorsa was revisited in 1951 with the object of testing this theory of their origin. The evidence obtained then is set out in this paper.

The Context: Glen Iorsa

The largest glen in Arran, Glen Iorsa (Fig. 1),[3] cuts NNE to SSW through the heart of the northern granite boss of the island, and then with a sinuous but generally westerly course passes across the surrounding Dalradian Schists and lastly the Old Red Sandstone.[4] The long NNE-SSW reach has been attributed by Gregory [5] to Tertiary faulting, but there is no field evidence to support this notion. The '1000-ft platform' [6] of Arran, which bites into the northern hills, transecting Dalradians, Old Red Sandstone, and Tertiary granite, extends into the Iorsa drainage basin, and gives the landscape a polycyclic character. Thus on the west a broad shelf above the 1000-ft contour, on which Loch Tanna rests, lies between Glen Iorsa proper and Beannta Bharrain, Bhreac and Tarsuinn, whilst a lower, smaller platform fragment east of Sail Chalmadale also overlooks the valley. Across the glen no such flat surfaces exist, but there is a marked break

of slope at 900 ft—increasing northwards to 1250 ft—above which the slopes ease off for some distance (Photograph 2); for example, this can be clearly seen between the head of Glen Iorsa and Caisteal Abhail. This shoulder may relate to the same phase in the denudation chronology as the '1000-ft platform'. Near the sea, the divides, flanking the glen, are bevelled by lower erosion surfaces than the '1000 ft'.

It was most probably a rejuvenated young valley, incised into these high level surfaces, that suffered the rigours of Pleistocene ice action.

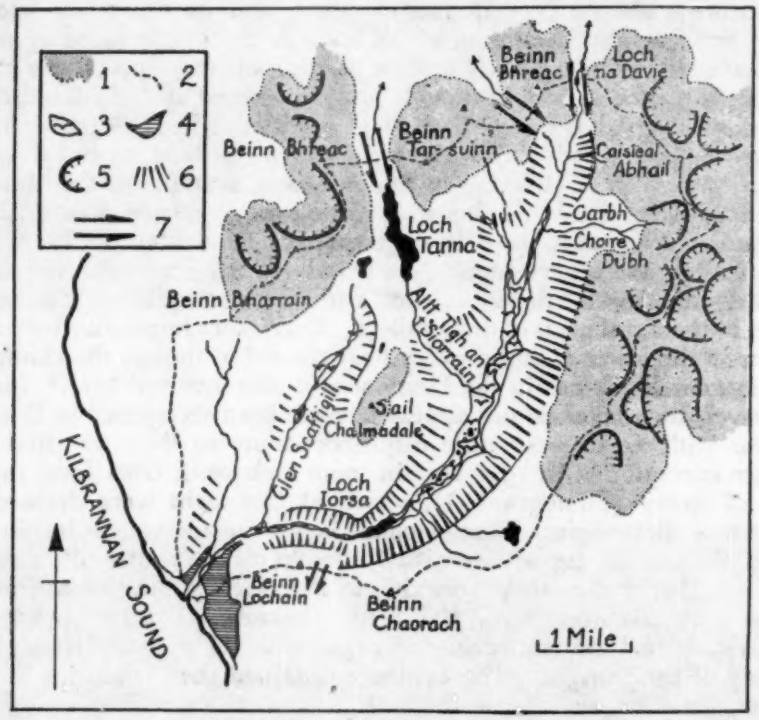


Fig. 1. Selected morphological elements of Glen Iorsa. 1. Land above 1250 feet. 2. Watershed of Iorsa Water drainage. 3. Alluvium. 4. 100-foot Raised Beach. 5. Corries. 6. Ice-steepened valley wall. 7. Ice-eroded cols.

It was transformed by that action into a broader U-shaped trough (Photograph 2), with glacially steepened walls and a rounded, somewhat cirque-like head. Some tributaries such as that issuing from Garbh-Choire Dubh were made to 'hang' quite abruptly. Nevertheless, Glen Iorsa is not a simple glaciated valley, because mainland ice overflowed three cols on the north. The passage of ice between Caisteal Abhail and Beinn Bhreac (942456), and between the latter and Beinn Tarsuinn, no doubt accounts for the imperfect state of development of the valleyhead cirque of Glen Iorsa, whereas erosion by the ice stream which flowed south from the head of Glen Catacol through the col between Beinn Tarsuinn and Beinn Bhreac (906443) explains

the more gradually sloping valley wall of Glen Iorsa immediately north of the stream, Allt Tigh an t-Siorrain, flowing out of Loch Tanna. The walls of Glen Iorsa are steepest on the eastern, concave side of the valley, against which the ice from the north and north-west impinged in convergence. In the neighbourhood of Loch Iorsa, both walls are steep : this may be related to the narrowing of the valley here and to its change of direction. The congestion here seems to have led at some stage in course of the glaciation to an escape of ice through the small col between Beinn Lochain and Beinn Chaorach southwards into the valley of the Auchencar Burn.

West of its junction with the Scaftigill Burn, Glen Iorsa opens out widely in the last mile of its length ; this coastal embayment is floored by the 100-ft Late-Glacial Raised Beach, here partly eroded across Old Red Sandstone but mainly constructional (deltaic) in nature.

The Longitudinal Profile and Associated Features

A convenient line of levelling by the Ordnance Survey [7] enables the construction of a fairly accurate longitudinal profile of the Iorsa Water (Fig. 2), which focuses attention on the minor features of the valley floor.

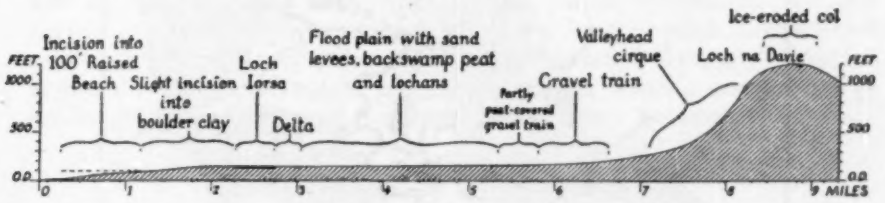


Fig. 2. Longitudinal profile of the Iorsa Water. Vertical exaggeration. 6 x.

Ice erosion has markedly flattened the watershed at the head of the glen, to such an extent that Loch na Davie, a small, swampy lochan on the floor of the col, drains both north and south. The contours are strongly suggestive of the watershed having been shifted northwards towards the side of ice approach in the manner described by Linton.[8] Issuing southwards from Loch na Davie, the stream suddenly steepens in gradient as it falls down the backwall of the amphitheatre head of Glen Iorsa. There follows an easing of the gradient at an almost regular rate down to the 200-ft contour, accompanied in the lower part by the deposition of narrow alluvial patches of a bouldery nature. For three-quarters of a mile below the 200-ft contour, there is a coarse gravel train a quarter of a mile wide, on which the traces of a relict braided channel system are to be seen ; the river gradient remains quite marked. This gravel train is not in process of construction to-day and may be attributed to a Late-Glacial phase of aggradation, when the slopes were less completely vegetated and much subject to solifluction and when spring thaws regularly augmented stream flow on a large scale. Similarly the steep and coarse alluvial cones farther down the valley, built by the side streams where

they meet the bottom of the glacial trough, are no longer in active formation and they also may be related to the subarctic conditions of a Late-Glacial phase.[9] The cone of the Allt Tigh an t-Siorrain is the largest and is seen on Fig. 3 to press the Iorsa Water to the eastern side

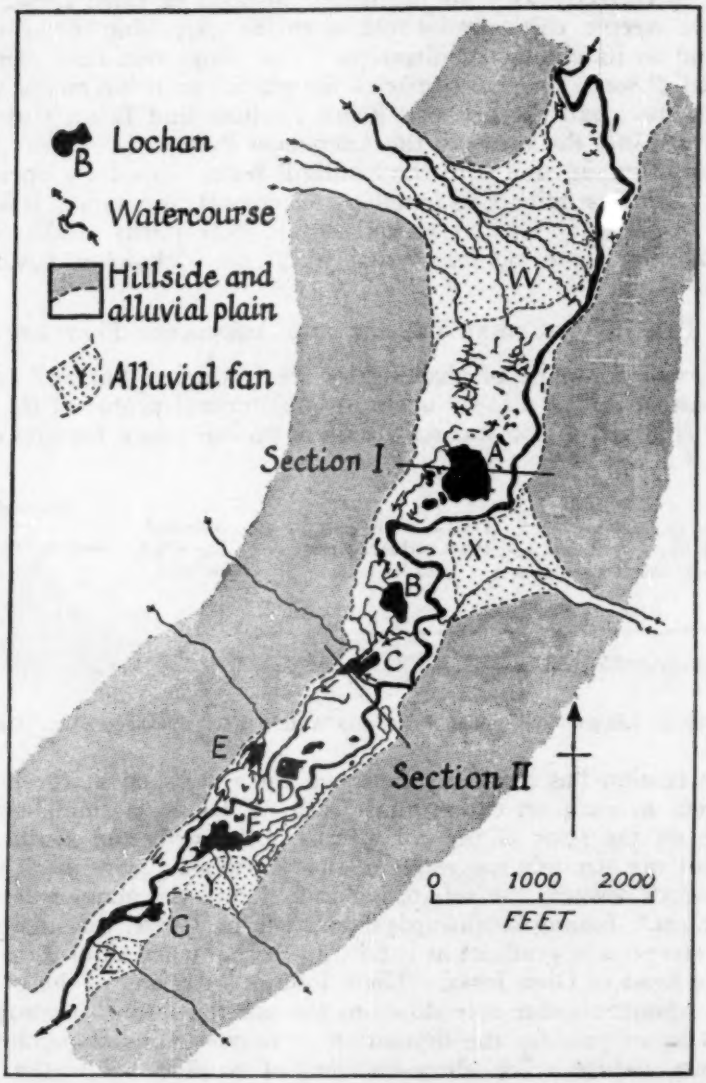


Fig. 3. Lochans in Glen Iorsa. Based on Air Ministry vertical photographs of 1946.

of the valley. Above this fan, the gravel train of the main valley floor has already become partly covered with peat, the river has begun to meander and tiny lochans appear on the flanks. Down the valley from the same fan is a long reach of very small and uniform gradient where the river meanders markedly and most of the valley plain is

peat-covered; here are found the lochans under consideration (Photographs 1 and 2).

From this reach (to be analysed in detail later), the Iorsa Water debouches through a delta into Loch Iorsa, which is quite distinct in nature from the lochans already mentioned (Photo 2). This loch was not sounded but appeared quite shallow when viewed from above.[10] Nevertheless, the two weirs of boulders, built just below the loch, do not account for its existence, which has been attributed to a hollow in the drift.[11] No linear barrier of moraine is to be seen, though there is undoubtedly a drift plaster over the valley floor, into which the river is incised some 15 ft about 200 yards below the loch. However, as likely an explanation as an irregular drift cover would seem to be glacial deepening of the valley above its narrowing and westward bending noted above.

From Loch Iorsa to the sea the gradient steepens and in association the course of the river straightens as noted by Mort. At first, the stream is slightly incised into the valley bottom drift, giving rise to pseudo-terraces in the boulder clay; afterwards the incision is made into the 100-ft Beach deposits and underlying drift. Recent alluvium is restricted to small, discontinuous patches. This section of the longitudinal profile suggests two nick-points, approximately at 140 ft and 65 ft, and thus two waves of erosion passing upstream. To link these to the two negative movements of sea level implied in the 100-ft and 25-ft Raised Beaches so well exemplified round the shore of Arran is the obvious correlation, but it ignores the known complexity of sea-level changes between the formation of these beaches.[12]

The Formation of the Lochans

Fig. 3 depicts the part of Glen Iorsa where the lochans are found.[13] Here the alluvial flood plain averages 300 yards across but is constricted almost out of existence both above and below by the fans (W, Z) of side streams. The flood plain is very gently inclined, falling only 10 ft in practically 1½ miles of the valley—2 miles of river course because of the meandering. The river bed along this reach is for the most part of sandy granite gravel, though there are boulders where the alluvial cone X is being undercut, and at several points where the banks have recently collapsed, the bed is of sand. In profile the bed is undulating in detail, bars and deep hollows (swales) succeeding one another in rapid succession; at a very low water-level, the shallowest water measured over a bar was 6 inches, whereas the greatest depth recorded was over 12 feet. Low levees embank the river almost continuously (Photograph 1) and can be seen in the two levelled sections of Fig. 4; they rise between 2-4 ft above the general level of the flood plain, except where the river is very close to the hillside when the very narrow flat rises almost to the height of the river bank. The levees are narrow, the outward slope usually being about 20 yards wide. The vegetation[14] of the banks is characteristically dominated by the purple moor-grass, *Molinia caerulea*, with a marked tussock habit (Photograph 3). The tussock s are incut at the base by water erosion

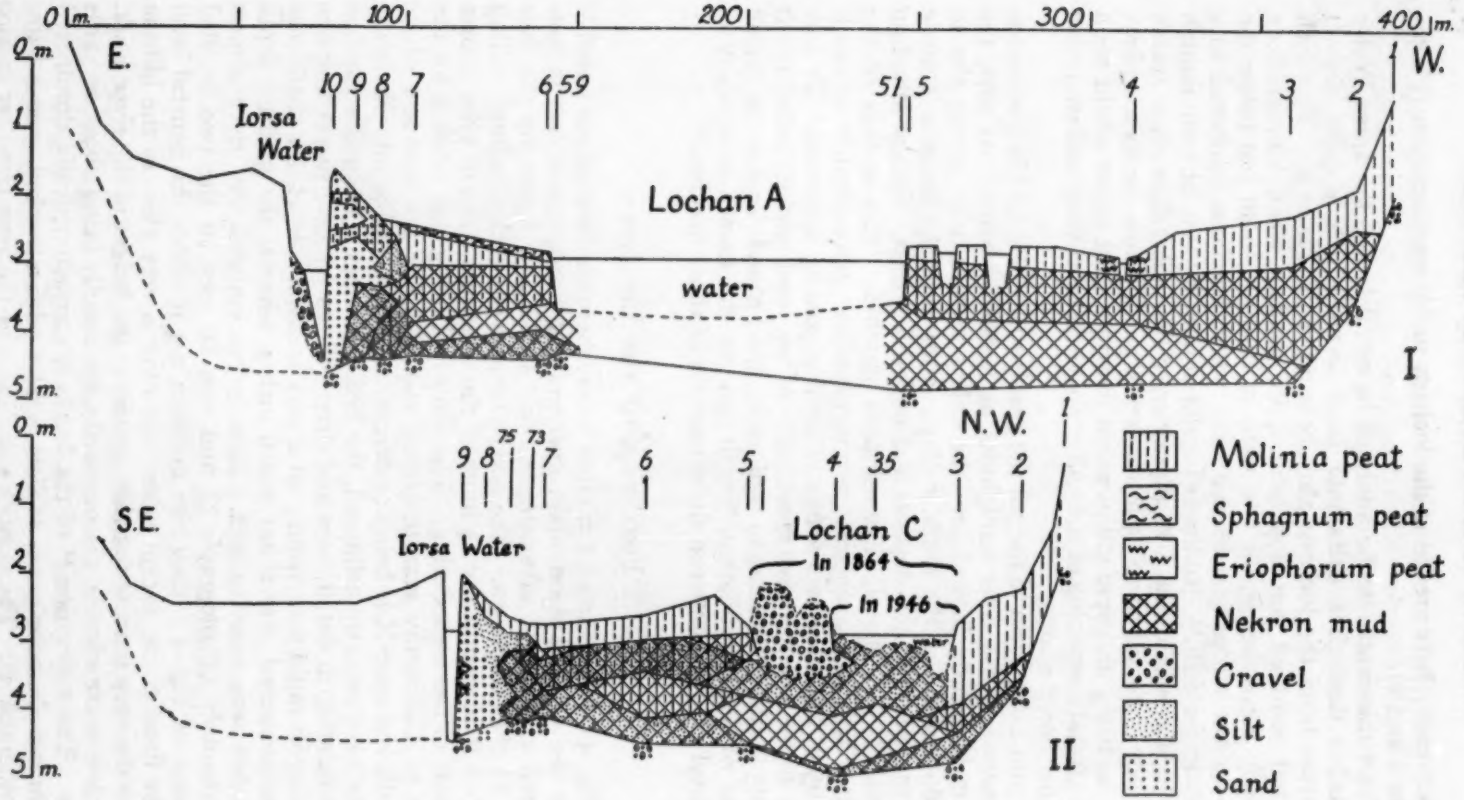


Fig. 4. Sections (*cf.* Fig. 3) in the alluvium of Glen Iorsa.

and the ground between them is either bare or covered by water-lain dead *Molinia* debris. The pronounced tussock development is associated with river flooding ; on the blanket bog of the hillsides and the highest parts of the valley floor, the purple moor-grass grows in a continuous carpet. Along some stretches of the levees, bracken has invaded to become codominant in parts.

Inevitably the lower areas away from the river are of poor and indeterminate drainage : there are intricate patterns of small water channels, large numbers of pools and some half-dozen lochans, of which the largest is, however, only 200 yards by 150 yards. Small hillside burns may join the river directly, where the latter abuts on to the fans they have built at the edge of the valley floor ; alternatively they run into the devious systems of flanking channels and lochans, ultimately reaching the river some way down the valley through a breach in the levees. Not all the breaches serve regularly as outflows into the river ; two at least are normally inlets from it and feed lochan C. The outflow from C passes between lochans D and E before joining the river.

The vegetation of these flanking depressions shows some differences from that of the river banks and from the blanket bog of the valley sides. In parts the *Molinia* does not grow in tussocks, and where these do occur, they show no sign of erosion. Many of the wetter areas are also less completely dominated by *Molinia* ; cotton-grasses (*Eriophorum vaginatum* chiefly, but some *E. angustifolium*) and bog-moss (*Sphagnum* spp.) become dominants in certain parts. Bog-rush (*Schoenus nigricans*), deer grass (*Trichophorum caespitosum* = *Scirpus caespitosus*), star sedge (*Carex echinata*), bog asphodel (*Narthecium ossifragum*), bog myrtle (*Myrica gale*), cross-leaved heather (*Erica tetralix*) and sundew (*Drosera rotundifolia, D. longifolia*) are other important species to be found in these mixed-*Molinia* communities, which experience persistent wetness, yet are not unduly subject to the mechanical effects at least of river floods.

To test the theory that the lochans originated through levee building as the hydrological pattern and the relative heights of levees and lochans suggest, a line of bores on either side of the largest lochan A was put down with a Hiller type peat-borer.[15] As shown in Fig. 4 I, a bottom of granite gravel, with some sand, is met at a shallow but uniform depth across virtually the full width of the flood plain ; this gravel floor is readily interpreted as the continuation of the gravel train found at the surface higher up the valley but here buried under some 2 to 3 metres of later accumulations. In bores 3, 4 and 5, overlaying the gravel bottom is a grey-brown or green-brown organic mud, with some coarse plant detritus, chiefly *Molinia* root-felt ; this mud thickens towards the lochan and apparently extends under its waters from the evidence of a bore, 51, a few feet out from its steep margin. At its margins the lochan is 2-3 ft deep and it is not thought to be very much deeper in the centre. On the far side, bores 59, 6 and 7 have grey-brown silty coarse detritus-mud or yellow-brown silty clay-mud above the gravel, but purely organic muds succeed these. On both sides of the lochan, the nekron muds change gradually upwards through

muddy peats to peat free from mud. The peat is predominantly of *Molinia* root-felt, and as this peat type tends rapidly to become an amorphous pasty mass as it humifies, the boundary between it and the muds is in any case very difficult to determine. Close to the surface where the vegetation to-day is not completely dominated by *Molinia*, *Sphagnum* and *Eriophorum* have contributed to the formation of peat.

The bores in the outwardly sloping river bank revealed a different structure. By the river (bore 10) brown or grey sand, slightly peaty here and there, reaches from the top of the levee down to the underlying gravel. Bores 9 and 8 have sand overlying silty coarse detritus nekron muds.

The stratigraphy may be interpreted in this way. After the deposition of gravel over the valley floor, perhaps by a braiding stream in Late-Glacial times, drainage became confined to a single channel in normal flow and the river began to build sandy banks for itself. Shallow water and swamps stretched between these banks and the hillsides ; the muds which accumulated here contain so much coarse detritus that it is unlikely that the water was everywhere as deep or as free from vegetation as in the present lochan, which has only *Lobelia dortmanna* and a little *Menyanthes trifoliata* growing in it. To begin with, some silt and clay was carried over the growing levees to be incorporated in the organic muds near to them, but later, mineral sedimentation was restricted to the narrow belt by the river. As the levees grew higher, *Molinia* fen encroached from the hillsides and the riverside, forming a layer of firm peat over the muds ; the area of open water was reduced to its present dimensions and at the same time deepened. The evidence of this section does therefore support a simple process of lochan formation by levee building. The concept that the lakes formed to the flanks as a more or less simultaneous concomitant of the rising river banks seems to fit the stratigraphical data better than a theory that a large lake occupied the whole valley floor in the first place and was split up by the extension of deltaic ' fingers ' into it.

It is now appropriate to note the similarities and contrasts between the various lochans and to consider whether they may represent different stages of some evolutionary development. In this connection it will be useful to make comparison between the outlines of the lochans as shown on the O.S. 6 inches to 1 mile Survey of 1864 and in Fig. 3, based on Air Ministry vertical air photographs taken in 1946. Lochans A, B and D show no change in shape over these 82 years. These three are the most isolated from the river and from the hillside burns ; D has neither inlet nor outlet channels, A has only one devious and small outlet channel, B (Photograph 1) is also fairly well cushioned from the effects of varying river level by poor and indirect channels. Consequently these lochans remain well filled and maintain fairly constant levels. This, combined with the accompanying reduced circulation and aeration, may restrict aquatic plant growth and so minimise organic accumulation in them. Certainly mineral sediment from the river is largely excluded.

Lochan F has also changed little in extent, although it has a good outlet into the river and varies considerably in level with the latter.

It also lies close to fan Y, over which a burn runs in distributaries into the lochan. There is little sign of gravel or sand going into the lochan from the fan, but great mats of plant debris are washed in and no doubt fine mineral sediment also. As a consequence of these various characteristics the water has been vigorously colonised by plants, in particular by buckbean (*Menyanthes trifoliata*) and bulbous rush (*Juncus bulbosus*). Further shallowing may therefore be anticipated, as long as favourable factors—an open outlet to the river and inflow from the fan—remain unchanged. Yet the outlet might be sealed in a flood and the active channels on the fan might swing away from the lochan at least temporarily.

If lochan A seems the farthest developed, it is perhaps possible to see at G the beginning of the type. Here the 6 in. map shows a lateral spread of water to the east of the river, but broad contact with the main channel remains evident. By 1951 the main river flow now follows what was mapped by the Ordnance Survey in 1864 as quite a subsidiary channel and a sand bank lies between this channel and the swampy pool to the eastern flank. Except when the Iorsa is in spate, there is only slight in- and out-flow of water. Thus there appears to have been some advance towards the isolation of a small lochan from the river.

Nevertheless, retrogression can be detected also : lochans C and E have smaller extents in the 1946 air photographs than on the O.S. survey. In C there has been encroachment at the north-eastern corner where there is inflow from the river and at the southern end near a larger and more direct entry of water from the river. Both these channels leading from the Iorsa Water to lochan C have banks built above the neighbouring ground, dividing the backswamps into compartments as it were. Lochan E has lost area at the northern end where a hillside burn flows in and at the southern end where there is inflow from the outlet channel of lochan C. Both C and E fluctuate markedly in level with the river's behaviour, and their very shallow floors dry out frequently and bear in consequence a good deal of vegetation (especially *Juncus bulbosus*). To investigate this aspect of lochan development, a section (Fig. 4 II) was constructed from a line of bores across the southern end of lochan C where there had been loss of open water. A fairly level bottom of coarse sand and gravel was again proved * and the Iorsa levee was once more of sand changing laterally to silt a short distance out from the river channel. In the flanking depression, brown silty coarse detritus mud accumulated near the river, but farther towards the hillside, green-brown nekron mud with little silt or plant detritus accumulated in clearer water. It is possible that at this time there was no inlet channel from the river to the lochan ; at any rate, the muds become siltier upwards as this channel developed. Outside the lochan limits of 1864, *Molinia* peat is found at the surface. Not only is the lochan being shallowed by very silty mud but the south-eastern corner has been built high and dry since 1864 by a patch of coarse sandy gravel brought in from the river. The section shows it to have been raised as high as the neighbouring river levee.

From these facts it may be argued that the lochans begin to form in the manner indicated by the features at G. Sandbanks start to build up by the sides of the river and cut off partially flooded areas to the flanks. Gradually the passages across the lower parts of these banks are silted up and the now continuous bank becomes colonised by vegetation, which arrests more efficiently sand and silt carried over by flood waters. Mud forms in the side depressions, and eventually peat formation by fen vegetation encroaches from hillside and riverside. But now the lochan has become isolated from the river. Its level is more constant and vegetation more restricted in consequence ; shallowing both by organic mud and mineral sediment may thus be slowed down and not keep pace with the raising by sand of the banks close to the river course. This mature stage is illustrated in lochan A. Yet this simple evolution is liable to upset by other agents. Side streams may help to shallow lochans and indeed completely fill up parts of them. More important, the main river may breach its own levees at any stage and carry some of its load directly into the flanking depressions to eliminate partly or wholly lochans in any phase of development. These breaches will be most likely to occur on the outer curves of meanders, where the river will erode its own sand levee ; both the channels leading into lochan C start from breaches in such positions. Against the straightforward evolutionary scheme may therefore be set a concept of constantly varying and conflicting forces—levee building on the one hand, levee breaching, valley side fan extension, organic mud and peat formation on the other—which produce a fluctuating pattern of lochans, deepening and expanding, or shallowing and contracting, from time to time and from individual to individual.

However, the ultimate development is more certain. Levee construction should slow down as their growth increases the river gradient and enables the river to carry more of its load into Loch Iorsa. Delta extension in the latter will lead to further aggradation upstream, of course, yet eventually as the profile of equilibrium is approached, the upward building of the levees will slacken off and thus enable mud and peat to shallow and encroach on the lochans, gradually eliminating them from the flood plain. Still later the rejuvenation apparent below Loch Iorsa to-day will pass upstream ; incision into the flood plain will lead to the final removal of all trace, both as landforms and sediments, of levees and lochans.

Discussion

In a recent presidential address to the Association of American Geographers, R. J. Russell deprecated the lack of interest of his colleagues in alluvial lowlands amongst other, in his view, neglected aspects of geomorphology. He said then : " Classical geomorphology concerned itself almost wholly with erosional forms. Only recently have students turned to matters of mass movement or to depositional features." [16] How far this assertion extends with truth to this country needs discussion. If it has some validity in respect of alluvial lowlands, an explanation is not far to seek. These areas have been so much

modified at the hands of men, their peculiar hydrological patterns so upset and their ' micro- ' landforms so obscured that attention could with good reason concentrate on the larger erosional landforms. It is only in such an isolated and agriculturally negative context as an Arran glen, that the natural relief and drainage of a flood-plain can still be seen and the various natural agents are still able to operate undisturbed. The study of such instances may therefore have the additional advantage of enabling the former conditions of the many, more extensive flood-plains, now converted to full agricultural use by drainage and embankment, to be more accurately envisaged.

The particular physical feature discussed here—the flanking lake due to levee formation—may thus have been a common feature in these islands in former historical times. At this juncture it may be recalled that such an origin has been claimed [17] for the Norfolk Broads, lakes as important for the human geography of the region in which they lie as any in Britain. However, recent work [18] indicates that the ' ronds ' which separate many of these lakes from the rivers, have not been built by the sand and silt of the river floods but have been formed in part by the deposition of estuarine clay along the flanks of tidal channels and in part by the accumulation of peat on these clay banks. The Broads, though similar in pattern, have a quite different origin from that postulated here for the Glen Iorsa lochans.** Tidal rise and fall and tidal currents, not river floods, seem to have been responsible for the formation of the Fenland 'roddons' also; these raised silt banks dammed back freshwater in flanking depressions to produce the great medieval ' meres ' of the Fenland.[19] Nevertheless, farther up the alluvial lowlands beyond the reach of estuarine transgressions, river levees of fluviatile silt may well have been accompanied by lakes closely similar in character and origin to the Glen Iorsa lochans. Thus a schematic section by H. H. Swinnerton [20] across the Trent valley near Nottingham is suggestive of such lakes there. Moreover, the Geological Survey [21] has mapped areas of lacustrine clay, shell marl and peat (which may well include lacustrine organic mud) in several tributary valleys of the middle Trent, as, for example, at Gotham Moor and Sinfin Moor ; these former side-valley lakes are most likely to have been due to the aggradation of the main valley. Elsewhere evidence may survive on the ground and in maps and documents to provide in the Britain of historical times further instances of former lakes of the broad genetic type to which attention is drawn here.

[1] Davis, W. M., and Snyder, W. H. Physical Geography. 1898. Pp. 279-280.

[2] Pfannenstiel, M. Die Quartärgeschichte des Donaudeltas. *Bonner Geographische Abhandlungen*, 1950, Heft 6, p. 68.

[3] Refer also to Sheet 77, Island of Arran, O.S. 1 inch to 1 mile Popular (Scotland).

[4] Tyrrell, G. W. The Geology of Arran. *Memoirs of the Geological Survey, Scotland*, 1928.

[5] Gregory, J. W. The Pre-Glacial Valleys of Arran and Snowdon. *Geological Magazine*, 1920, 57 : 481-495.

[6] Mort, F. The Sculpture of the Goat Fell Mountain Goup. *S.G.M.*, 1911, 27 (*12*) : 632-643.
Mort, F. The Sculpture of North Arran. *S.G.M.*, 1914, 30 (*8*) : 393-404.

[7] O.S. 6 inch to 1 mile Sheet 243, Buteshire.

[8] LINTON, D. L. Some Scottish River Captures Re-examined. *S.G.M.*, 1949, 65 (*3*) : 123-131.

[9] Whether to Zone I or Zone III of the Late-Glacial it is not possible to surmise on the evidence available. See note * below.

[10] The local gamekeeper estimated 6 feet as the greatest depth.

[11] TYRRELL, G. W. *Op. cit.*, p. 4.

[12] SIMPSON, J. B., *et al.* Discussion on the Raised Beaches of the Forth and Tay. *Advancement of Science*, 1940, Vol. 1, p. 254.

[13] The limits of the alluvium on this map are due to Mr W. Farrington, B.A. I must also thank him for the help he gave in boring and levelling.

[14] The notes on vegetation incorporated in this account are based on a report by Mr J. Franks, who made a number of belt transects and general observations on the vegetation in 1951. I thank him for permission to make use of this material and his general help in the field.

[15] The loan of this borer by the Royal Society and a grant from University College, Leicester, for the field work, is acknowledged with gratitude.

* At bore 4, this gravel was loose enough to penetrate with a peat-borer. The following deeper horizons were recorded :

222-368	cms.	Sand and gravel.
368-380	,,	Brown muddy sand, with gravel.
380-414	,,	Grey-brown silty mud, with little plant detritus.
414-525	,,	Green-brown nekron mud, with little silt and plant detritus.
525-530	,,	Fine grey sand with occasional gravel.
530-575	,,	Grey-brown sandy mud.
575-585	,,	Grey sand with much coarse gravel.
585-609	,,	Yellow sand, with gravel. Gravel stopped bore.

Bores 6 and 8 were taken with difficulty to 4·6 m. from their respective surface levels but failed to disclose a similar layer of organic deposit within the basal sands and gravel ; there can only have been a small lakelet to the side of the valley at this stage also. The sequence of deposits is suggestive of the Late-Glacial Allerød oscillation but it is as likely to belong to the early Post-glacial.

[16] RUSSELL, R. J. Geographical Geomorphology. *Annals of the Association of American Geographers*, 1949, 39, p. 1.

[17] MARR, J. E. The Scientific Study of Scenery, 1900, p. 165 and Note D.

CHATWIN, C. P. East Anglia and Adjoining Areas. *British Regional Geology*, 1937, p. 83.

[18] JENNINGS, J. N. The Origin of the Broads. *R.G.S. Research Series*, 1952, No. 2.

** Further work on the Broads since this paper was written is indicating that many, perhaps all, of the Broads are artificial in origin, emphasising still more the burden of the first paragraph of this discussion. See interim note by J. M. LAMBERT and J. N. JENNINGS, *Geographical Journal*, 1953, 119 (1) : 91.

[19] GODWIN, H. The Origin of Roddons. *Geographical Journal*, 1938, 91 : 241-250.

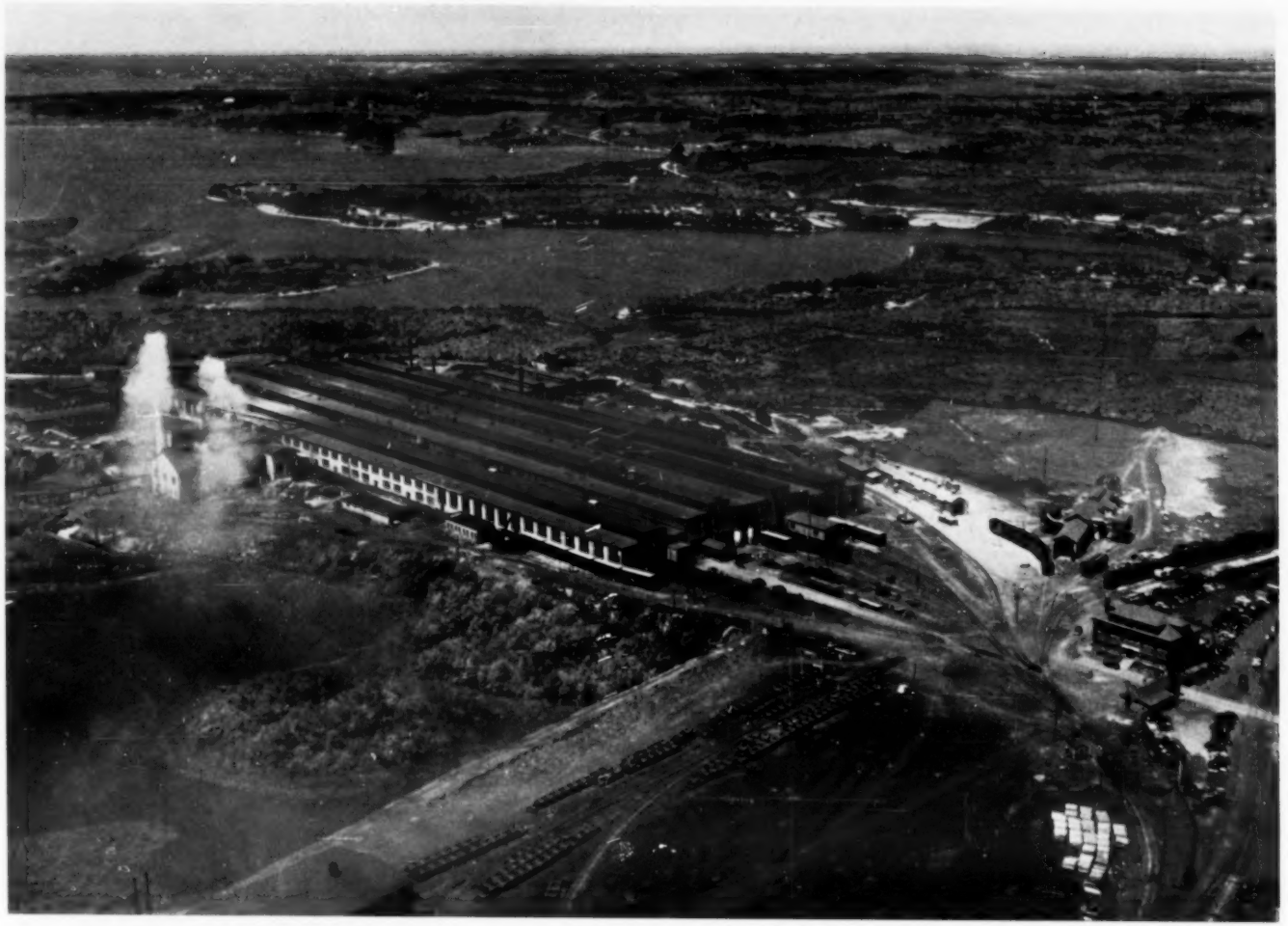
JENNINGS, J. N. The Origin of the Fenland Meres. *Geological Magazine*, 1950, 87 : 217-225.

[20] SWINNERTON, H. H. Pleistocene and Later Deposits. Guide to the Geology of the East Midlands, 1948, p. 79.

[21] GEOLOGICAL SURVEY. 1 inch to 1 mile New Series Sheets 126, 141 and 142, and the relevant Sheet Memoirs.

THE TOWN OF NEW GLASGOW IN THE VALLEY OF EAST RIVER, LOOKING EAST

GREEN HILL, ONE OF THE SEVERAL HILLS WITHIN THE CUMBERLAND-PICTOU LOWLAND, WITH A FARM AT ITS FOOT TYPICAL OF THE REGION



PART OF THE DOMINION STEEL AND COAL CORPORATION'S WORKS AT TRENTON

THE NEW GLASGOW REGION OF NOVA SCOTIA

By Norman L. Nicholson

Running through the northern part of Nova Scotia is a belt of high land, with an average elevation of 800 feet, which is known as the Cobequid Mountains in the west and the Pictou-Antigonish Highlands in the east. Between this upland and the tidal waters of Northumberland Strait lies a hilly coastal plain, sometimes referred to as the Cumberland-Pictou Lowlands, which varies in width from one to ten miles. A variety of landforms characterise the shore where the lowland meets the sea, but none of the coastal features is more remarkable than the three-fingered, claw-like inlet known generally as Pictou Harbour, the finest harbour on the southern shore of the Gulf of St Lawrence. So wide is this water system that practially all east-west land transportation routes through the Cumberland-Pictou Lowlands must move around its southern end. Some four miles to the south of Pictou Harbour, the upland belt is broken by a slightly lower and more gently rolling gap which is a natural route for the roads and railways leading from Halifax, Truro, and the rest of southern Nova Scotia to the northern plain. Not far from the place where this north-south road meets the east-west road, the town of New Glasgow has arisen—a natural hub for the commerce, transport, and activities of much of the plain in which it is so centrally and strategically located. The three arms of the sea which join together as Pictou Harbour are the drowned estuaries of the East, Middle and West Rivers which drain into them. East River estuary extends further south than the other two and is navigable for ships of between 300-400 tons for several miles. It is at the limit of such navigation that New Glasgow stands.

The Towns

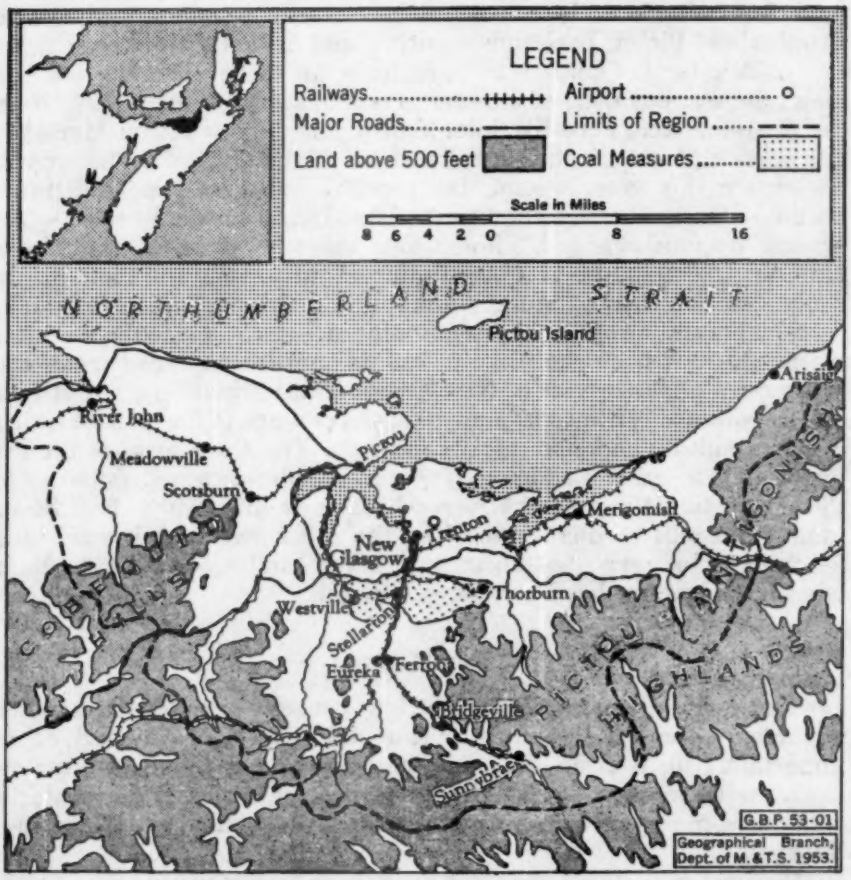
The original establishment of New Glasgow resulted from other advantages, for it is located near to useful deposits of clay and, more important still, it is on the northern edge of a coalfield of some 35 square miles in extent. Roughly quadrilateral in shape, this coalfield contains some 25 recognisable seams, several of which are of unusual thickness.

Within the coalfield are three overlapping areas of coal deposition. The oldest, most deeply buried and smallest of these areas, occurs in the west, around Westville. The youngest area is in the east, around Thorburn. This section contains the coal which is nearest the surface and covers the greatest area. The third area, intermediate in age and size between the other two, is centred upon Stellarton.

The coal was discovered in 1798, and as the mining of it developed, residential areas for the miners and their families grew up around the collieries. This growth came slowly. At first the coal was dug for local household use only. Then its value spread to Pictou, where many of the blacksmiths substituted it for the traditional charcoal. It was not until 1825, however, that a town began to take shape around

Albion Mines which, in 1899, was incorporated as Stellarton, named after the starry or " stellar " way in which the coal burned. Westville developed still later, after 1865, while the village of Thorburn grew out of the settlement known first as Vale Colliery.

In the meantime, New Glasgow had become established as the business and commercial centre for the activity taking place to the south of it. For further upstream, on the East Branch of East River, between Eureka and Sunnybrae, deposits of iron ore had been dis-



The New Glasgow region, Nova Scotia.

covered. They were mined as early as 1828, and smelting tests were made on them at Albion Mines. More active operations were carried on about 1893, after two small blast-furnaces had been erected at Bridgeville and Ferrona. These furnace sites possessed a number of geographical advantages. They were near the iron ore deposits as well as deposits of limestone which could be used as flux. Water supplies were abundant, and there was plenty of hardwood which could be made into charcoal for furnace-heating.

The Bridgeville plant was located almost on the iron ore; its

limestone was hauled three miles from Springville ; ample water was provided by building a 25-feet dam on Mill Brook, only 700 feet from the furnaces, and the mining property included acres of forest and woodland throughout which were scattered beehive brick-kilns for the carbonisation of the wood. Another iron field was also being worked at this time over in the north east corner of the region, near Arisaig, some of the iron ore, at least, going to feed the Ferrona furnace. As a result of these operations, by 1872 New Glasgow had developed an iron and steel industry to add it to its growing diversity of interests.

To historic Nova Scotia, however, New Glasgow is a modern town since it was not founded until after 1800, whereas Pictou, on the northern shore of the harbour and only eight miles across the water from New Glasgow, had its beginnings a good deal earlier. As early as 1774, Pictou became established as a timber-exporting centre, a trade which reached its heights between 1800 and 1820. By the late 1780's, the local timber had led to shipbuilding, and Pictou rapidly became one of the most outstanding Nova Scotian ports in this industry, its name being synonymous with all the varied aspects of seafaring life. One of the most famous of Canadian ships, the *Royal William*, though not built in Nova Scotia, left Pictou in 1833 to make the first of the trans-Atlantic crossings entirely under steam. Still another ship, the Pictou-built *Hamilton Campbell Kidston*, became famous as the largest to sail up the Clyde. That, however, was in 1850, when a 1400-ton vessel was a remarkable achievement. As time went on, New Glasgow also entered the field of shipbuilding and between 1840 and 1883 rivalled its older neighbour, with vessels varying in size from 200 to 1500 tons. But while Pictou has a good harbour and flourished when travel was by wooden ships and the raw timber trade was at its height, it was a little off the beaten track when travel by road came into its own. Gradually New Glasgow, with the help of the automobile, captured the position that Pictou once held, particularly after steel-making was added to its varied activities.

During their time, the local iron mines produced about 135,000 tons of ore, but they were all exhausted or considered uneconomic to develop by the early part of this century. However, with ores imported from Newfoundland, the steel industry survived. As early as 1878, the ironworks had spread north of the boundaries of New Glasgow, where another centre arose which, in 1911, was incorporated under the name of Trenton. Trenton's steel-making operations developed rapidly, and to-day it is one of the linchpins of the famous Dominion Steel and Coal Corporation (DOSCO) producing thousands of railway freight-cars and coal-cars annually. It has also pioneered in the transportation of hot ingots over long distances.

Engineering and its various ramifications were, of course, no strangers to the New Glasgow region. The fact that New Glasgow produced the first of Nova Scotia's steamships in 1893 often overshadows the event which occurred much earlier, in 1827, when a 20 horse-power steam-engine was erected at Albion Mines near Stellarton, to aid in the extraction of the coal. Similarly, the ovens installed at the Ferrona Iron Works in 1891 were the first retort coke-ovens to be

operated successfully on the American continent. Then, in 1836, the construction of a railway was commenced which eventually ran from the Albion Mines to what was known as the Loading Ground, about six miles north of New Glasgow. Although built to move the coal from the mine to deep water, this railway can justly claim to have been the first in Canada, if not in North America, to use all-metal rails. It was the forerunner of the Canadian National Railways which to-day run from Truro through Stellarton, New Glasgow and Merigomish to Sydney, with branch-lines radiating out to Pictou, Pictou Landing, and Sunnybrae.

The air age has now succeeded the railway era and, with the development of aviation, an airport was established at Trenton to serve the region. It is owned and operated by the town of New Glasgow and connects it and its neighbouring settlements with Charlottetown on the north, Halifax on the south, Sydney on the east, and Moncton on the west.

Gradually too, New Glasgow, Stellarton, Thorburn, Trenton, and Westville became linked up by an inter-urban bus service. At the beginning of the present century, Pictou was also directly linked to New Glasgow, by small steamer. Although this is no longer the case, there are good roads leading from Pictou to New Glasgow, either round the west side of the harbour or over the ferry from Pictou to Pictou Landing and up the East River. Indeed, there are good roads throughout the New Glasgow region, whose construction was facilitated by the deposits of gravel left scattered over the area when the ice sheet retreated at the end of Glacial times.

Thus to-day, four towns and one large village are located within a radius of six miles from New Glasgow. While Stellarton, Westville and Thorburn are primarily concerned with the winning of coal, Trenton with the iron and steel industry, and Pictou with the sea, these historic specialisations have gradually become more and more diversified. Thus mattresses are manufactured at Stellarton, paints and varnishes at Trenton, and biscuits and cutlery at Pictou. The peak of the diversity is at the core of the area, for New Glasgow not only turns out a variety of iron and steel-ware, bricks, tile products and woollens, but, with its hotels and commercial establishments, provides the services and facilities necessary to co-ordinate the activities of the region. While the population of New Glasgow itself is about 10,000 and exceeds that of any of its neighbours, the whole group has a population of over 27,000, which is about the size of a small city in Ontario.

Settlement

These industrial and commercial developments about the mouths of the Pictou rivers had ripple-like effects on the surrounding countryside, effects which extended almost to Tatamagouche and Cape George. They were limited on the west and south by the highlands, on the east by the distance from the New Glasgow centre, and on the north by the sea. This area had always yielded a variety of food resources. Long before the Europeans came it provided means of

subsistence for the Micmac Indians who inhabited it. Most of the Indian settlements were along the coast, usually at the mouths of the larger rivers. Merigomish Island appears to have been their headquarters in this part of Nova Scotia, but Pictou and New Glasgow both appear to have been established on or near the sites of Indian villages. In such locations food almost dropped into the mouths of the inhabitants, for wild fowl were plentiful and the sea and the rivers abounded in cod, salmon, trout, and lobster. Very little effort was needed to harvest the clams and oysters from the shallow waters near the shore, while inland the forests supported game animals of many kinds which provided those who hunted them with food and furs, some of which were even traded with the European fishermen who ventured to this area. The bears were so numerous at the time the first white settlers arrived that legendary stories about them are legion. Indeed, Middle River was at one time known as Bear Creek on this account.

In time, the Indians were joined by the French as the governing power, but during the 150 years of their control they did not colonise the New Glasgow area very extensively and in any case confined their attention to a few coastal and insular outposts. Traces of an early French settlement have been found at Merigomish, but there was a larger establishment on the western edge of the New Glasgow region, at Tatamagouche, mainly because it lay on the direct route from the large Acadian centre at Truro and the French settlements on Prince Edward Island.

Settlement in the modern sense occurred after the Treaty of Utrecht, in 1763, when the French settlements were abandoned and English-speaking immigrants arrived. The way was led by people from the United States. In 1767, the brig *Hope* arrived at the present site of Pictou with several families from Maryland and Pennsylvania, but the most noted event in the settlement of the New Glasgow area occurred six years later when the *Hector* arrived with the first of many emigrants from Scotland. Many of these newcomers recognised in the Cobequid Mountains and the Pictou-Antigonish Highlands a visible environment similar to the one which they had left on the other side of the ocean, and they made for the hill-tops and established their pioneer communities. Unfortunately, in those days, there were no such things as geological or soil surveys in British North America, and many of these early settlers were to find from bitter experience that the hard rocks of the highlands did not produce fertile soils and, hence, that agriculture was impossible on some of the sites they had chosen. This, however, was not the case throughout the area, particularly on the lowlands and along the river valleys, so that to-day lowland villages like Scotsburn, Hopewell, and Sunnybrae are thriving agricultural communities, while settlements like Dalhousie Mountain have completely disappeared.

Forest and Woodland

The growth of the mining and industrial towns, however, has had the effect of accentuating the differences between the good and the

sub-marginal agricultural areas. The lands best suited to agriculture are being used with intensity and success which increases as rapidly as the poorer agricultural lands are abandoned to forest regeneration. The coastal lowland of the New Glasgow region originally supported outstanding forests, particularly of pitch and white pine, most of which were cut down to make way for agriculture and provide a source of revenue through the exports of squared timber. On the East Branch of East River large amounts of yellow birch, beech, and maple were cut to feed the charcoal producing kilns of the iron and steel operations. To-day, as the agricultural area contracts so the forested area expands, so that now, as in former times, most of the New Glasgow region is covered with forest and woodland, and the large numbers of " brows " or piles of logs beside the roads, waiting for transportation to the mills, is testimony to their utilisation. The cleared land is nearly all along the shore or the river valleys, called locally " intervales."

The Farms

About one third of the people in the New Glasgow region nowadays derive their livelihood from farming. The early settlers found in northern Nova Scotia a climate not unlike that of the Scotland they had left. Summer temperatures in the sixties and an annual rainfall of 40 inches were possibly a little higher than those to which they had been accustomed, but the growing season in their new homeland was best suited to hardy crops like hay and oats, with which they were familiar.

To-day, in the proximity of the urban centres these crops have been incorporated into a live-stock raising programme which emphasises dairy cattle, hogs and poultry, and thus supplies milk, butter and eggs to the people of the towns. In the eastern part of the region, which is more remote from the large settlements, sheep and beef cattle are found in significant numbers on the northward facing slopes of the Pictou-Antigonish Highlands. The farms in this eastern area are often small, self-sufficing units producing few farm products for sale, in contrast to the rest of the New Glasgow region where agriculture is carried out on a more commercial basis. In general, however, throughout the region the greater part of the farmland is devoted to pasture and only a small proportion to the growing of crops.

With the establishment of a canning factory at Pictou, greater attention has been paid to the growing of peas. Hardy vegetables such as turnips, potatoes and carrots are grown in significant quantities, and the region is also the major single source of its own requirements of corn, Brussels sprouts, and pumpkins. In many places there are flourishing orchards, particularly on the slopes of the major valleys, which mainly produce apples, although plums, pears and cherries are also important. The village of Scotsburn has a thriving creamery, egg-grading station, and co-operative which processes and markets much of the agricultural produce, and town and country come together in the creameries of Pictou, New Glasgow, and Stellarton.

The Fisheries

The increasing specialisation in the towns and on the farms has been matched by similar utilisation of the resources of the sea, for to-day the New Glasgow region is synonymous with lobsters. Fishing villages are strung out along the coast, which include Arisaig and Merigomish in the east and Rivers John and Brule on the west. But Pictou dominates this activity and has the reputation of being one of the largest lobster producing centres in the world. Off the shore which it serves, over three million pounds of lobsters have been taken in a single season, along with salmon, smelt, mackerel, and herring. The lobster taken in the region generally accounts for about 15 per cent. of the total for Nova Scotia. Much of it is exported to other parts of Canada and the United States, as fresh meat. In recent years the New Glasgow region has supplied more than half the total Nova Scotian production in this respect, while the four canneries in the area accounted for more than one third of Nova Scotia's output of canned lobster in 1952. In the neighbourhood of these canneries it is a common sight to see the waste material from the lobsters scattered over the fields as a fertiliser. Indeed, in many of the coastal localities both farming and fishing exist on a part-time basis. Nowhere is this more evident than on Pictou Island, the largest island in Northumberland Strait and 12 miles from the town of Pictou to which it is linked by ferry.

Recreation

Pictou Island is still curiously isolated from the mainland, however, for it has no electricity, no commercial gas stations, no cinemas, nor automobile taxes. But it does have a natural attractiveness. For Pictou Island does have some fine bathing beaches, and its peaceful, restful atmosphere is an attraction to those seeking a quiet vacation. This is by no means the least of the many diverse recreational resources of the New Glasgow area. Within a stone's throw of any of the towns and villages of the region one can find some unique and unspoiled attraction, whether it be a quiet stream for fishing, a shady pool for bathing, or a beach for relaxing in the sun and ocean. Even the mining towns generally lack the grim aspect associated with their counterparts in Europe or some other parts of Canada. Indeed, many of the smaller mines are situated in the middle of farmland and woodland, and one is hardly conscious of their presence. In recent years, more and more of these recreational resources have become easily accessible. The coastal roads have been improved and developed so as to reveal to best advantage the coastal scenery, and lead to the growing colonies of summer cottages. The coastal road from Tatamagouche through River John and Toney River to Pictou and thence to New Glasgow has been paved and given the attractive name of the "Sunrise Trail". Just off this trail, at Caribou, is the mainland terminus of the car and passenger ferry to Prince Edward Island, which passes quite close to Pictou Island and from which a seaward view is obtained of the resort

of Pictou Lodge. It seems only a matter of time before the coastal road from New Glasgow to Antigonish through Merigomish, Lismore, and Knoydart will become a worthy counterpart to the "Sunrise Trail", for, in addition to the islands and coastal features north of it, it skirts the prominent scarp edge of the Pictou-Antigonish Highlands, and road, coast and mountain gradually meet in a scenic climax near Cape George, on the eastern rim of the New Glasgow region.

Of particular beauty are many of the unique and unspoiled vistas to be seen from the vantage points in the highland rim of the area or from the isolated hills which vary the relief of the coastal plain. Green Hill, seven miles west of New Glasgow, is perhaps the best known of these. From the top of its lookout tower, 700 feet above sea-level, on a fine day one can see the checkered pattern of farm and forest, the silver ribbons of the rivers, the old town of Pictou huddled beside its serene harbour, and across the waters of Northumberland Strait, Prince Edward Island—a complete visual impression of New Glasgow and its region which lingers in the memory as long as any of its much publicised rivals.

This article is based on field work done on a survey by the Geographical Branch, Department of Mines and Technical Surveys, Ottawa, and is published by permission of the Department, by courtesy of Dr J. Wreford Watson, Director of the Geographical Branch and Honorary Corresponding Member of the R.S.G.S.

Photograph of the Dominion Steel and Coal Corporation's Works at Trenton, courtesy of Mr D. S. MacNeil.

THE TROPICAL RAIN FOREST

Review by Joy Tivy

No general account of the tropical rain forest has been presented since A. F. W. Schimper's *Pflanzen-Geographie auf physiologischer Grundlage* was published in 1898. The authorised English translation, *Plant-Geography upon a Physiological Basis*, edited by Percy Groom and I. Bayley Balfour, was published in 1903 and reviewed in this *Magazine*[1] by Dr Marion Newbigin. This edition was revised and expanded by Von Faber in 1935. Since the date of the original publication not only has ecology emerged as a science, bringing with it a flood of new concepts on the nature of plant life, but, in particular, a wealth of detailed information has been accumulating about tropical vegetation. Professor Richards, admirably equipped with his own personal knowledge of rain-forest vegetation in the three major tropical regions of Africa, South America, and Malaysia, has undertaken the formidable task of assembling this widely scattered information and of presenting it in this critical and carefully weighed appraisal of the present state of knowledge of the ecology of the tropical rain forest.[2]

Following the general principles of the Anglo-American school of ecologists, Professor Richards systematically analyses this great plant community and its habitat: step by step he re-examines every facet in the light of recent research, assesses carefully the relationships between

this community and its habitat, presents critically all theories, and qualifies many early generalisations while questioning the validity of others. The result is a work of some length and no mean detail, the importance of which for the geographer cannot be overstressed.

The division of the book into six main parts, and the systematic treatment of detail within each, facilitates its use for either serious reading or for reference. The first part, on Structure and Physiognomy, merits special study by geographers. For, it is on the relationships which exist between plant form and climate that many of the often too glibly accepted generalisations about the tropical rain forest are based. Here, the structure and physiognomy of each synusia of the forest are minutely examined in an effort to assess their diagnostic value in characterising the community as a whole and its constituent strata. Two important conclusions emerge from this section.

First, the generally accepted concept of a climatic climax as a " stable plant community of unvarying floristic composition in a state of relative equilibrium with its environment " may require some modification in the light of recent findings. Studies on the structure and regeneration reveal that in many rain-forest associations young individuals of the dominant trees may be scarce or even absent, and the floristic composition of the upper storeys very different from that of seedlings likely to replace them. This indicates that not only do the dominant strata vary in composition from place to place, but that the combination of dominant species at a given place and at a given time is probably succeeded by a different one. The proviso is made, however, that—whether accepted or not—this cyclic theory of regeneration is not universally applicable to all mixed rain-forest communities, nor to any of the stable edaphic communities, such as the mature mangrove.

Second, that although the physiognomic characteristics of the rain-forest community, common to a wide range of unrelated species, are connected in some way with the particular environmental conditions, for the most part they cannot be proved to be adaptations with any real survival value ; some, particularly in the undergrowth where the greatest variety of foliage exists, may probably arise from obscure internal causes and are able to survive in the favourable and constant temperature and humidity conditions of this stratum. That the physiognomic features also vary considerably in frequency from one stratum to another is not surprising in view of the variety of microclimates within the forest as a whole.

This latter aspect is fully elaborated in Part Two, in which the main factors of the environment—except the biotic one, about which information is lacking—are examined. A general review of the tropical rain-forest climate reveals nothing new, while the vexed question of defining the climatic boundaries of the rain forest remains unsolved. Attempts to do so must inevitably be handicapped by lack of precise knowledge of the exact boundary of the rain forest—since it is probably a potential climax over a much larger area than it actually occupies now —and by the paucity of climatic data. Some of the attempts to define world climatic and associated vegetation groups by means of empirical

climatic indices, it is admitted, give broad correlations ; but the field ecologist, with his supersensitive appreciation of the complex interaction of factors which determines the distribution of plant communities and of the present incomplete state of his knowledge about them, remains cautious of correlating biological limits too closely with a simple integration of climatic factors. The complexity of the climatic factor alone is strikingly portrayed in the discussion of the microclimates occurring in the various strata of the rain forest, and of their relation to plant physiology. Also, in spite of the incomplete state of knowledge about tropical soils, and of the often confused and still controversial state of the subject, enough data are available to reveal that rain-forest communities, contrary to a formerly accepted view, reveal different soil conditions as clearly as in other regions.

An appreciation of these differences involves some knowledge of the floristic composition of the main climax associations. This aspect, together with a classification and analysis of the primary successions or seres leading to the establishment of a stable climax rain forest form the basis of Parts III and IV. The last two parts of the book, Parts V and VI, which deal respectively with the tropical rain forest under limiting conditions, and in relation to man, should be noted as of particular interest and value. The discussion of the inadequacy of Schimper's somewhat simplified classification of lowland tropical climatic formations, and in particular, that of a tropical grassland or savanna formation, is but one of the many pertinent problems which are raised. Savanna in which trees are dominant may be regarded as a climatic climax, but most types of savanna grassland are probably fire climaxes, or on occasion due to edaphic conditions ; these cannot be considered as representing a climatic climax in equilibrium with a tropical grassland climate, and occupying a place in the natural climatic ecotone from tropical rain forest to desert.

Full justice has not been done here to Professor Richards' scholarly work, and only a few indications have been given of its value and importance for geographers. It has become increasingly evident that many of the broad—and often quoted—generalisations about the climax vegetations of the world are in need of re-examination, if not of serious revision, in view of the recent advances in ecology. It is, therefore, appropriate that Professor Richards should supply the means of such revision for one of the largest untouched blocks of climax vegetation in the world. And, although he lays no claim to infallibility and regards his work mainly as a pointer for further research, botanists, zoologists, and not least geographers, indeed anyone, to use his own words, " who is concerned with the rain forest as a plant community or an environment " must be indebted to him for setting the house in order with such lucidity and zest.

[1] *S.G.M.*, 1904, 20 (*8*) : 446-447.

[2] *The Tropical Rain Forest* : An Ecological Study. By P. W. RICHARDS, M.A., PH.D. 9¾×6¼. Pp. xviii+450. 43 figs. 15 plates. Bibliography. Cambridge : University Press, 1952. 63*s*.

REVIEWS OF BOOKS

EUROPE

Scottish Farming in the Eighteenth Century. By JAMES E. HANDLEY. 8½×5½. Pp. 314. London: Faber and Faber Ltd, 1953. 25*s*.

From the current spate of literature dealing with eighteenth-century Scotland, Dr Handley's book, as the first truly systematic account of farming in the transitional period of improvement, emerges as a standard text. The first four chapters deal with the unimproved Scotland: landscape, system of agriculture, condition of the farming classes, and the Highlands and Islands. The two chapters on the theorists and critics, and on the pioneers of improvement, constitute a critical survey of contemporary writers and innovators—a shrewd and illuminating account of the new ideas and techniques which appeared in the country as the century advanced. The remaining chapters delineate Scotland in process of vigorous change: the coming of the potato, the new system of agriculture, the influence of kelp, sheep, and emigration. A chapter is devoted to the abolition of the runrig system and the appropriation of waste-land and common, the enclosure movement, and the introduction of new crops and implements, and new methods of cultivation and stock-management.

Many data relating to geographical distribution could have been presented more advantageously in maps. The reader should beware of the unintentional implication in some passages that improved and unimproved Scotland belonged to distinct periods, whereas they co-existed in the 1790's. New material from the Forfeited Estates' Papers is indicative of much more that has not yet been utilised by historians. All future students of the period will appreciate the extensive bibliography provided.

A. G. M.

The Scottish Islands. By GEORGE SCOTT-MONCRIEFF. 8½×5½. Pp. 208. 98 illustrations. 4 sketch maps. London: B. T. Batsford Ltd, 1952. 21*s*.

Illustrated lavishly, this is another of the popular, finely presented Batsford books. The author deals systematically with the Scottish islands and describes the scene, past and present, with vividness and sincerity. But his findings are occasionally ill-balanced, and the rather mannered use of Lowland Scots words in discussing the Hebrides does seem out of place.

A. T. A. L.

Skye: The Island and its Legends. By OTTA F. SWIRE. Foreword by Sir William Tarn. 7½×5. Pp. xii+244. Sketch map. London: Geoffrey Cumberlege, Oxford University Press, 1952. 15*s*.

This is a very readable and, in places, fascinating collection of folklore, legends, and historical episodes "thread as it were on a necklace" round the roads of Skye. Written with authority, humour, and sympathy, the book includes many tales handed down by word of mouth alone. When offering explanations, the author never dispels th enchantment. One wonders if it be accident that the legendary origin of the Cuillins comes so near the geological truth.

A. T. A. L.

The Central Highlands. Edited by H. MACROBERT. 8½×5½. Pp. viii+145. 15 figs. 49 photographs. End-paper sketch map. [The Scottish Mountaineering Club Guides.] Edinburgh: The Scottish Mountaineering Club. Second edition, 1952. 15*s*.

The area dealt with in this guide-book is bounded on the west and north by Loch Linnhe, the Great Glen, and the Monadh Liath; on the east, by the Highland railway; and on the south, by the Oban railway, the Moor of Rannoch, and Loch Rannoch. In the second edition, only the principal rock climbs and more historical routes have been given in detail; new climbs have only been briefly summarised. More detailed descriptions are given in *Rock Climbs in Glencoe and Ardgour.* The one-quarter inch to the mile map included in the first edition (1934) has been replaced by a sketch map, as it is rightly considered that for practical purposes a one inch to the mile map is required. A new feature of this edition is mention of areas which are suitable for ski-running. This adds to its usefulness.

A. H.

Granite City: A Plan for Aberdeen. By W. DOBSON CHAPMAN, M.A., P.P.T.P.I., L.R.I.B.A., F.I.L.A., and CHARLES F. RILEY, DIP.ARCH., DIP.T.P., A.R.I.B.A., M.T.P.I. Foreword by The Hon. Thomas Johnston, P.C., LL.D., F.E.I.S. 13×9¾. Pp. xx+168. 22 figs. 73 plates. City Development Plan (4¼ in. to 1 mile). [Published on behalf of the Corporation of the City and Royal Burgh of Aberdeen.] London: B. T. Batsford Ltd, 1952. 42*s*.

The non-professional reviewer of a planning survey, such as this for Aberdeen, falls between two stools: admiration for the imagination and work involved, and doubts as to the feasibility of the plan, even under the time-schedule envisaged by the authors. Certainly this most magnificently produced and illustrated plan for Aberdeen is visionary. While admitting that planned changes are vitally necessary, is it really essential to move the main railway station two hundred yards to the north? Is it wise to develop a sea-front on the lines of a south coast resort when the climatic conditions are so different and the holiday season so much shorter? And is it socially and culturally desirable to lessen the contact between town and gown by closely delimiting, and erecting gates to, the University "precinct"? Such criticisms must not detract from the good features of the plan. The improved road network, the relocation and regrouping of industries, and other schemes seem wise and are carefully formulated. One feels, however, rather like a forester who inspects a bed of seedlings and wonders whether he will ever see them reach maturity. K. W.

Round and about Spain. By A. F. TSCHIFFELY. 8¾×5⅝. Pp. 317. Decorations and sketch maps by the Author. End-paper map by A. Spark. London: Hodder and Stoughton Ltd, 1952. 20*s*.

A charming and colourful story of a four-months' journey on a motor cycle in Spain is presented by this well-known author. The description of the landscape, the people and the incidents he encountered is lightly and vividly drawn. The reference to Spanish terms tends to intensify local colour. The author has a sympathetic understanding of the Spanish character, which he delineates accurately yet generously. There are, however, some errors in his topographical descriptions, such as on page 154 where he describes the Albufera as a fifteen-mile stretch of water, into which flows the river Turia: neither of these statements is based on fact. Except for a very few such slips, the account is accurate and good entertainment.

J. M. H.

ASIA

The Orphaned Realm: Journeys in Cyprus. By PATRICK BALFOUR (Lord Kinross). 8½×5½. Pp. 221. 17 illustrations. Decorative end-paper sketch map. London: Percival Marshall and Co. Ltd, 1951. 18*s*.

Despite the modest subtitle, the entire colony is admirably described. The simple style makes easy reading and, combined with the author's knowledge of Cyprus and width of interests, places *The Orphaned Realm* among the more useful and enjoyable of travel-books. The illustrations are excellent. C. R. V. G.

Die Türkei. By KARL KRÜGER. 8½×5½. Pp. 392. 13 figs. 68 plates. Berlin: Safari-Verlag, 1951.

Written in English, Professor Krüger's succinct account of *Kemalist Turkey and the Middle East* [see *S.G.M.*, 1933, 49 (*1*): 51] showed that he had abundant material for a more detailed and comprehensive book. The quincentenary of the capture of Constantinople by Mohammed II would seem to be a suitable occasion for the publication of the author's present survey of the historical, political, and economic geography of Turkey. The history and character of the Turks are discussed in relation to the geographical background, and there is a useful chapter on the Turkish language. Other chapters deal with foreign influence in the Osmanli empire, Abdul Hamid II and Panislamism, Enver Pasha and the Young Turks, Kemal Atatürk and the significance of the Anatolian capital, and with present-day internal and foreign affairs. The second half of the book gives detailed accounts of communications, agriculture, mining, power, banking, industries, cultural activities, and tourism in modern Turkey. I. E. C.

Tirich Mir: The Norwegian Himalaya Expedition. Translated by Sölvi and Richard Bateson. Foreword by Professor Georg Morgenstierne. 8½×5½. Pp. 192. 57 illustrations. 3 sketch maps. London: Hodder and Stoughton Ltd, 1952. 21*s*.

It is remarkable that four Norwegian mountaineers, only one of whom had Himalayan experience and that acquired on a reconnaissance expedition in 1949, should have been able to conduct a successful expedition in 1950 to the summit of Tirich Mir, a peak of over 25,000 ft. in Kashmir. In addition to these Norwegians there took part one English officer, who had no previous mountaineering training. A botanist, a geologist, and two photographers formed a competent scientific staff. It seems evident that the experience both of mountaineering and equipment acquired in Norway stood the climbers in very good stead in the Himalayas. The account of the expedition, written by the various members who took part, is interesting and well worth reading. The translation, in spite of a few errors, is good, and the photographs are adequate. A. H.

The Mount Everest Reconnaissance Expedition, 1951. By Eric Shipton. 10½×8½. Pp. 128. Photogravure illustrations. London: Hodder and Stoughton Ltd, 1952. 25*s*.

The book is divided into two parts: firstly, the account of Mr. Shipton's party's reconnaissance of the south face of Everest and other valleys lying south of the frontier, and secondly, there is a collection of extremely fine photographs of the country through which they passed. The book is brief but well worth reading both on account of the description of the expedition itself and on account of the photographs. A. H.

AFRICA

The Zambesi Journal of James Stewart, 1862-1863, with a Selection from his Correspondence. Edited by J. P. F. Wallis. 10×6½. Pp. xxvi+276. Portrait. Map of the Shiré River (1867). [Central African Archives: Oppenheimer Series, No. 6.] London: Chatto and Windus, 1952. 35*s*.

James Stewart joined the Zambezi Expedition in 1862 in order to reconnoitre the country of the Lower Zambezi Basin, revealed by Livingstone's discoveries, with a view to establishing a mission of the Free Church of Scotland. His journal gives the earliest detailed published account of the region, providing a valuable supplement to the relevant sections of Livingstone's *Narrative* and to Coupland's *Kirk on the Zambesi*. For the historical geographer there is material in plenty: the devastation of slave raiding, the failure of the Universities' Mission at Magomero, the activities of the native peoples and their relations with the Europeans, the terrible results of malaria and blackwater fever, the quarrels of the explorers and the hopeless task of navigating steamers amidst endless shoals and marshes, and finally, the activities of the Portuguese. Accuracy of observation has made Stewart's picture of the physical conditions as good as any that have since been penned. Stewart's report to the Cotton Supply Association of Manchester and numerous extracts from his correspondence, together with the earliest reliable map of the Shiré Valley, form a useful appendix. Photographic illustration would have greatly added to the interest of the volume, but the print and the format are excellent. W. B. M.

AMERICA

Suwannee River: Strange Green Land. By Cecile Hulse Matschat. 8½×5½. Pp. 256. Illustrated by Alexander Key. [Rivers of America.] Edinburgh, Glasgow, London: William Hodge and Co. Ltd, 1951. 15*s*.

The Suwannee River, meandering from the wilderness of the Okefenokee Swamp in Georgia to the Gulf of Mexico just north of Cedar Keys, is far less familiar than Stephen Collins Foster's nostalgic song. Miss Matschat has presented not a treatise on hydrology but an enchanting account of the people, plants and animals inhabiting the river basin. Her description of the everyday life of the swamp folk, river folk, and gulf folk, and of the wildlife of this strange region is so deft that the reader is hardly aware of the wealth of information permeating her book. J. H. K.

The Rural Land Classification Program of Puerto Rico. Preface by Malcolm J. Proudfoot. 11×8½. Pp. vii+261. Illustrated. (Lithoprinted). [Northwestern University Studies in Geography, No. 1.] Evanston, Illinois: Department of Geography, Northwestern University, 1952.

Part of a research fund has been wisely used to begin publication of the results of research undertaken by members of the Department of Geography of Northwestern University. In the first number of these *Studies* are presented six related geographical essays concerned with the Rural Land Classification Program of Puerto Rico. Scope, extent, and methods of the field work involved are discussed by C. F. Jones. R. T. Batchelder presents a study in land use in the subhumid plain of the north west of the island, while physical land types and land use in the Caguas-San Lorenzo region are treated by V. W. Brockmann. Environment and economic activities in SW Puerto Rico are described by A. H. Doerr. A more specialised paper is that by Dr H. R. Imus, on the application of methods of farm economy analysis to the sugar cane economy of the Mayaguez area. In his essay on types and patterns of rural settlements, Dr J. F. Lounsbury concludes that "the problems of Puerto Rico primarily resulting from the pressure of population to secure a livelihood, can be solved only by sound and long term planning."

Many of the maps and other illustrations accompanying these essays will be found useful for teaching purposes. I. E. C.

Uruguay: South America's first Welfare State. By GEORGE PENDLE. 8×5¼. Pp. viii+100. 2 sketch maps. London and New York: The Royal Institute of International Affairs, 1952. 11*s* 6*d*.

Despite external pressure and internal turbulence, the smallest of the South American republics, with a population one half that of Scotland, has emerged as an autonomous democratic and progressive state which takes an active part in the United Nations. In this study of social, economic, and political conditions in Uruguay, Mr. Pendle gives the essential facts. A brief description of the characteristics of the land and the people is followed by an account of the evolution of modern Uruguay—with reference to the influence of the late José Battle y Ordóñez upon the Constitution of 1942 and constitutional reform of 1951—culminating in the present-day welfare state. The remaining two-thirds of this useful little book deal with finance, production, the arts and sport, foreign relations and party politics; individual chapters include essential statistical data. An adequate bibliography is provided in addition to references in footnotes. I. E. C.

POLAR REGIONS

The Antarctic To-day: A Mid-Century Survey by the New Zealand Antarctic Society. Edited by FRANK A. SIMPSON, M.A., DIP. JOUR. 9¾×7¼. Pp. 389. 50 figs. 46 plates. Folding map. Wellington: A. H. and A. W. Reed, in conjunction with the New Zealand Antarctic Society, 1952. 47*s* 6*d*.

Books of Antarctic sledge and ship journeys are common enough and generally welcome, even if they show much similarity one to another. This volume, however, is no story of travel but a compilation, by members of the New Zealand Antarctic Society, of the scientific side of our knowledge of the Antarctic, with photographs, abundant sketch maps, and a large folded map showing the outline of the continent —now almost complete. Sources and further reading are indicated by extensive bibliographies. The sub-Antarctic islands are included.

The book does not claim to be a history of Antarctic exploration, but embraces a useful sketch with full references to political claims of recent years. The physical chapters are the longest, as is natural, and most complete, but in the meteorological section the name of Robert C. Mossman should find a place. In the biological chapters, seals and whales receive very full notice. Birds are not treated at length, and botany, scanty as it is, should have more attention. On the map some new names appear: these are chiefly American. The Weddell Sea is now closed at its southern end by Edith Ronne Land.

The New Zealand Antarctic Society is to be congratulated on a useful, accurate, and well-informed book. R. N. R. B.

BIOGEOGRAPHY

Geography of Living Things. By M. S. ANDERSON, M.A. General Introduction by Frank Debenham. 7¼×4¾. Pp. xiv+202. 5 illustrations. [Teach Yourself Geography.] London: The English Universities Press Ltd, 1951. 8*s* 6*d*.

Biogeography may be defined as the study of the spatial distribution of living organisms, but Mrs Anderson approaches the subject from an anthropocentric point of view: "the study of the biological relations between man, considered as an animal, and the whole of his animate and inanimate physical environment"—thus providing a suitable approach to economic, social, and historical studies. Vividly written, the book deals with man as an animal, the direct effects of his environment, landforms and water supply, man and his food, the soil and soil conservation, and pests and diseases. This excellent survey of some of the relationships existing between man and his environment ends with sound advice to the budding biogeographer, and emphasises the need for working with, not against, nature.

J. H. K.

The Origin and History of the British Fauna. By BRYAN P. BEIRNE, M.A., M.SC., PH.D., M.R.I.A., F.R.E.S., F.L.S., F.Z.S. 8½×5½. Pp. x+164. 60 figs. London: Methuen and Co. Ltd, 1952. 18*s*.

Much has been written on this subject—especially on the mammals, birds, and certain groups of invertebrates—and this book does not claim to be a complete survey. The author pays most attention to the mammals, birds, butterflies and moths. In these groups, however, it is incomplete and has little to say on many orders. There is no claim to include extinct animals, but pests deliberately or accidentally introduced are included. As far as it goes, it is a welcome, brightly written book, but it is a pity that its scope is not wider. There are many interesting distribution maps.

R. N. R. B.

EDUCATIONAL

Practical and Experimental Geography. By W. G. V. BALCHIN, M.A., PH.D., F.R.G.S., F.R.MET.S., and A. W. RICHARDS, M.A., B.SC., F.R.MET.S. 8½×6½. Pp. viii+136. Frontispiece. 73 figs. New York: John Wiley and Sons Inc. London: Methuen and Co. Ltd, 1952. 12*s* 6*d*.

The claim of this book to be ingenious and in a large measure original is well-founded. It is intended to facilitate the teaching of geography by the use of models which pupils can construct for themselves. Scholars who understand the suggested models, which are very clearly set forth, will acquire a basic knowledge of geography. This really comprehensive volume shows models which deal with the earth, its movements and, in general terms, its structure. It also covers a study of the seas and climatic conditions—all in diagrammatic form—and concludes with some useful information on simple surveying and on the pictorial representation of statistical data.

G. M.

Geomorphologie. By FRITZ MACHATSCHEK. 9×6¼. Pp. 203. 89 figs. Leipzig: B. G. Teubner Verlagsgesellschaft. Fifth edition, 1952. *DM* 9.60.

Since publication of the first edition at the end of the first world war, Professor Machatschek's concise and judicious introduction to the science of geomorphology has been found acceptable to many students, and the second edition has been strongly recommended in this *Magazine* [1935, 51 (*3*): 190-191]. The text of the third and fourth editions showed only slight modifications, but in the present fifth edition has been considerably revised and expanded. Recently recorded data and theories have received due attention. A new chapter has been added, dealing with the climatic control of landforms, and the number of illustrations has been augmented. As the reviewer of the second edition pointed out, the book is "written in a style that is by no means difficult for foreign readers."

J. H. K.

Australia, New Zealand, and the Pacific Islands. Edited by E. D. LABORDE, PH.D., F.R.G.S. 8½×5½. Pp. xii+268. 48 figs. 8 plates. London : William Heinemann Ltd. Second edition, 1952. 12*s* 6*d*.

Economic, social, and political changes during the two decades since this book was first published [see *S.G.M.*, 49 (*4*) : 250-251] have rendered unavoidable a complete revision of the text. Sections relating to the Australian economy have been rewritten by R. J. Evans. The original concluding chapter on Pacific problems has been omitted in view of the fluidity of the political situation in the Papuan region. D. Gray, J. H. Stembridge, T. Tanqueray, and the editor have each taken part in bringing the text up to date. New illustrations have been provided. The second edition of this commendable, compact work will be appreciated by those preparing for the General Certificate Examination, and also by the general reader.

I. E. C.

PUBLICATIONS RECEIVED

EUROPE

Prehistoric Migrations in Europe. By V. GORDON CHILDE. 11½×9. Pp. x+249. 183 figs. [Instituttet for Sammenlignende Kulturforskning, Serie A, Forelesninger, 20.] Oslo : H. Aschehoug og Co. (W. Nygaard), 1950. *Kr.* 35.00. London : Kegan Paul, Trench, Trubner and Co. Ltd. 37*s* 6*d*.

Ein Innovationsverlauf in Europa, dargestellt in einer vorläufigen Untersuchung über die Ausbreitung der Eisenbahninnovation. By SVEN GODLUND. Lund Studies in Geography. Series B, No. 6 : 1-8. 1 fig. French summary. 1952.

Census of Woodlands 1947-1949 : Woodlands of Five Acres and over. 9½×6. Pp. 264. 9 figs. 11 plates. 19 maps. [Forestry Commission, Census Report No. 1.] London : H.M. Stationery Office, 1952. 12*s* 6*d*.

Early Scotland : The Picts, the Scots, and the Welsh of Southern Scotland. By H. M. CHADWICK. Introduction by Nora Kershaw Chadwick. 8½×5½. Pp. xxxi +171. 18 Photographs. Map. Cambridge : University Press, 1949. 15*s*.

Ninety Sixth Annual Report of the Registrar-General for Scotland, 1950. 9½×6. Pp. 409. Map. Edinburgh : H.M. Stationery Office, 1953. 10*s* 6*d*.

The Roads from the Isles : A Study of the North-West Highland Tracks. By D. D. C. POCHIN MOULD. 7½×5. Pp. ix+189. 17 illustrations. Sketch map. Edinburgh and London : Oliver and Boyd Ltd, 1950. 12*s* 6*d*.

The Firth of Clyde. By GEORGE BLAKE. 8½×5½. Pp. 288. 39 illustrations. End-paper maps. London : William Collins, Sons and Co. Ltd, 1952. 16*s*.

The Book of the Old Edinburgh Club. Twenty-eighth Volume. Edinburgh : Printed by T. and A. Constable Ltd. for the Members of the Club, 1953.

The County of East Lothian. By CATHERINE P. SNODGRASS, M.A., PH.D. Introduction by Sir Alexander Gray. 9×5¾. Pp. xv+460. 52 figs. 8 plates. Map (Quarter-Inch to the Mile). [The Third Statistical Account of Scotland.] Edinburgh and London : Oliver and Boyd Ltd, 1953. 20*s*.

England. Edited by L. RUSSELL MUIRHEAD. 6×4. Pp. lxxii+656. 72 maps and plans. [The Blue Guides.] London : Ernest Benn Ltd. Fifth edition, 1950. 25*s*.

A Physical Land Classification of Northumberland, Durham, and Part of the North Riding of Yorkshire. 11½×9. Pp. viii+40. 8 photographs. 5 maps. Newcastle upon Tyne : The North East Development Association, 1950. 30*s*.

The Northern Region, August 1952. Foreword by T. H. Summerson. [N.E.D.A. Publication No. 5 : 1-20.] Newcastle upon Tyne : The North East Development Association, 1952. 1*s*.

The Liassic Ironstones. By T. H. WHITEHEAD, W. ANDERSON, VERNON WILSON, and D. A. WRAY. Contributions on Petrography by K. C. DUNHAM. Preface by W. J. Pugh. 9½×6. Pp. viii+211. 24 figs. 8 plates. [The Mesozoic Ironstones of England. Memoirs of the Geological Survey of Great Britain.] London : H.M. Stationery Office, 1952. 25*s*.

Lincolnshire. By JOHN BYGOTT. 8½×5½. Pp. xii+281. 49 illustrations. Map. [The County Books.] London : Robert Hale Ltd, 1952. 18*s*.

The Origin of the Broads. By J. N. JENNINGS. 9½×7. Pp. 66. 31 figs. 8 air photographs. [R.G.S. Research Series, No. 2.] London : The Royal Geographical Society ; John Murray Ltd, 1952. 10*s*.

Essex. By J. CHARLES COX. Revised by C. HENRY WARREN. 6¼+3¾. Pp. xii+212. 50 illustrations. Map. [The Little Guides.] London: Methuen and Co. Ltd. Seventh edition, 1952. 9*s* 6*d*.

Companion into Berkshire. By R. P. BECKINSALE, D.Phil. 7½×4¾. Pp. xiv×237. 26 illustrations. End-paper sketch map. [The Companion Books.] London: Methuen and Co. Ltd, 1951. 10*s* 6*d*.

Census of Woodlands 1947-49: Woods of Five Acres and over. Welsh County Details. 13×7¾. Pp. viii+90. [Forestry Commission, Census Report No. 3.] London: H.M. Stationery Office, 1953. 4*s*.

The Electorate in the Country Districts of Scania, 1911-1948. By FOLKE LAGNERT. Lund Studies in Geography, Series B, No. 5: 1-25. 34 figs. 1952.

Holland To-day. By CICELY HAMILTON. 8½×5½. Pp. ix+162. 16 illustrations. London: J. M. Dent and Sons Ltd, 1950. 12*s* 6*d*.

La Vigne et le Vin en France. By PAUL MARRES. 6½×4½. Pp. 216. 11 sketch maps. Paris: Librairie Armand Colin, 1950. 180 *fr*.

Frankfurt and the Taunus: A Handbook for Travellers. By KARL BAEDEKER. 6½×4. Pp. 170. 67 sketches. 5 plans and 1 map. Hamburg: Karl Baedeker. New York: The Macmillan Company. London: George Allen and Unwin Ltd, 1951. 8*s* 6*d*.

ASIA

Asia: Manual Geografico. By GUSTAVO FOCHLER-HAUKE. 11×7½. Part I. *A-H.* Pp. 1-176. Part II. *I-O.* Pp. 177-351. [Serie Didactica, 3. Publ. No. 518.] Tucumán: Instituto de Estudios Geograficos, Universidad Nacional de Tucumán. Part I, 1950. Part II, 1952.

Regionale Typen in Jahresgang der Niederschläge in Vorderindien und ihre Beziehung zu Landschafts-grundlagen. By HILDEGARD LUDWIG. 11×7½. Pp. ix+144. 33 figs. 3 maps. [Abhandlungen aus dem Gebiet der Auslandskunde, Universität Hamburg, Vol. 57, C 16.] Hamburg: Cram, De Gruyter und Co., 1953.

The Making of Pakistan. By RICHARD SYMONDS. 8½×5½. Pp. 227. 3 maps. London: Faber and Faber Ltd. Second edition, 1950. 12*s* 6*d*.

Im Garten der göttlichen Nanda: Bergfahrten im Garhwalhimalaya. By RUDOLF JONAS. 9×6. Pp. 168. 93 plates. 3 sketch maps. Wien: L. W. Seidel und Sohn, 1948. $4.00.

CHAIR OF GEOGRAPHY, UNIVERSITY OF GLASGOW

Sincere good wishes, and grateful appreciation of his work for the R.S.G.S., accompany Professor ALEXANDER STEVENS, M.A., B.SC., on his retiral from the Chair of Geography, University of Glasgow.

His successor, as from October 1953, is Dr RONALD MILLER, M.A., Lecturer in the Department of Geography, University of Edinburgh, who is to be congratulated on his appointment.

HUGH MILLER'S COTTAGE IN CROMARTY

In looking back on his youth, Hugh Miller likened himself to "a wild fruit tree, rich in leaf and blossom; and it is mortifying enough to mark how very few of the blossoms have set, and how diminutive and imperfect the fruit is into which even the productive few have been developed." His fructification was more bountiful than he had estimated, and his talents, character, and achievement are duly appreciated all over the world.

The necessity which made Hugh Miller a stone-mason taught him to be a geologist. His ability as a writer enabled him to bring geology to the ken of the general public. Although now somewhat outdated, *The Old Red Sandstone*, *The Testimony of the Rocks*, *The Cruise of the Betsey* and other publications hold their place in the development of geological discovery. In other directions, too, his writing talents made a profound impression on public opinion. As editor of the Non-Intrusionist periodical *Witness* for many years he argued the pros and cons of Church

controversy with vigorous force and biting satire. With the same vigour he exposed and denounced the Sutherland clearances. It was in the *Witness* that he first published a series of articles which formed the basis of *The Old Red Sandstone.*

The small cottage in Church Street, Cromarty, where Hugh Miller was born on 10th October 1802 was acquired by his son, and later was handed over, together with part of his library, geological specimens, personal letters, and other exhibits, to the Town Council of Cromarty. When the financial burden became too onerous, the National Trust for Scotland was approached and agreed to accept the property, the required fund of £500 having been raised by public subscription, to which the Trust added £100. Provost Mackenzie of Cromarty duly handed over the Cottage to the Trust on 26th September 1938.

In 1902, scientists from all parts of the world attended the celebration in Cromarty of the centenary of Hugh Miller's birth. In October 1952, The National Trust for Scotland arranged a commemoration ceremony to mark the 150th anniversary. The Trust had decided to carry out a series of improvements at the Cottage to help make more interesting to the casual visitor as well as to the expert the geological and other exhibits. During the ceremony Lord Wemyss, Chairman of the Trust, made an appeal to the public for further funds to make this work possible. Already there has been an encouraging response which indicates beyond doubt that Hugh Miller is not forgotten. The work of rearranging the Cottage has been set under way and is supervised by Dr Charles Waterston, of the Geological Department of the Royal Scottish Museum, who has prepared a revised layout of specimens based on the three Hugh Miller books mentioned above.

The Trust does, however, need further support to complete this work, and all who are interested are asked to send donations to The Secretary, The National Trust for Scotland, 5 Charlotte Square, Edinburgh 2. The Secretary will also be glad to answer enquiries about the Cottage and the work in hand there. Under the ownership of the Trust, the Cottage is open to visitors on all weekdays from 10 a.m. to 12 and 2 p.m. to 5 p.m.—at other times the key is available at Miller House next door.

ROYAL SCOTTISH GEOGRAPHICAL SOCIETY

PROCEEDINGS

MEETINGS OF COUNCIL were held on 16th June and 31st July 1953.

ANNUAL GENERAL MEETING

The Annual General Meeting will be held in the Society's Rooms in Edinburgh on Tuesday, 13th October 1953, at 3.30 p.m.

RESIGNATION OF THE SECRETARY

The Council has accepted with great regret the resignation of the Secretary of the Society, Captain J. F. W. HAWKINS, R.N. (RETD.), who has gone to reside in the U.S.A.

NEWBIGIN PRIZE : 1954 AWARD

A Bronze Medal and Money Prize will be awarded for the best Essay, suitable for publication in *The Scottish Geographical Magazine* and not exceeding 7000 words in length, on any subject relating to the geography of Scotland.

Essays, typed and with any illustrations prepared for reproduction, in envelopes marked "Newbigin Prize," must be lodged with the Secretary, Royal Scottish Geographical Society, Synod Hall, Edinburgh 1, on or before 31st October 1954.

Printed in Great Britain by
T. & A. Constable Ltd., Edinburgh